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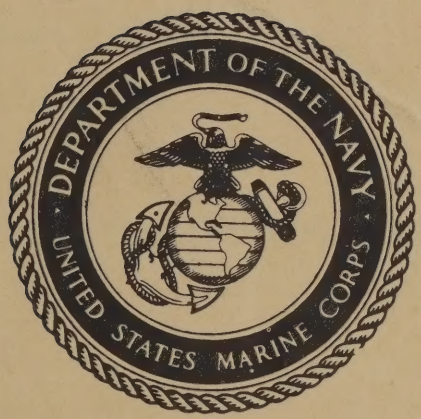
TECHNICAL MANUAL

RADIO INTERCEPT FACILITY

AN/TSQ-54A

OPERATIONS AND MAINTENANCE



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1. This Manual becomes effective upon receipt. It provides operating and maintenance instructions for the Radio Intercept Facility, AN/TSQ-54A.

2. To suggest changes or note discrepancies, forward a NAVMC 10772 directly to the Commandant of the Marine Corps (Code LMO-1).

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the equipment with the high voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be found in paragraph 12, chapter 15 of NAVMED P-5100; NAVPERS 10081-B, Standard First Aid Training Course (PCN 206 003000 00); Army Field Manual 21-11, First Aid for Soldiers (PCN 320 021160 00); DA pamphlet 40-5, First Aid/Emergency Treatment (PCN 305 026570 00); Army Graphic Training Aid, GTA 21-45 2-1/2X3-3/4, Artificial Respiration (PCN 308 007625 00); Air Force Manual 160-34, Airman's Training Manual; and Guide Book for Marines.

The following warnings appear in the text in this volume, and are repeated here for emphasis:

CAUTION

Be sure that all mounting pins are fully and properly fixed in the mounting slots and that the safety locking pin is in place before elevating the mast. (Page 2-19)

CAUTION

Exercise care not to inadvertently release the clutch lever on the bottom of the Griphoist. To do so will cause the antenna mast to collapse if the security pin is not installed. (Page 2-16)

CAUTION

To avoid antenna mast collapse, take care that the mast remains straight and plumb when tightening the upper guys. (Page 2-20)

CAUTION

Some interconnecting cables have been shortened to prevent stray coupling. Exercise due care in sliding equipment out of racks for checking cable connections, particularly the tape recorder/reproducer. Only 10 inches of cable slack is available to this unit. (Page 2-21)

WARNING

Immediate cover must be taken since fire may cause quick detonation of stored explosives or ammunition. Due consideration should be given to the highly flammable nature of gasoline and its vapor. Careless handling of gasoline may result in painful burns. (Page 2-25)

WARNING

Keep the blasting caps, detonating cord, and safety fuses separated from the charges until required for use. (Page 2-25)

WARNING

Take protective cover when firing artillery at ranges of 500 meters or less, and when firing rifle grenades or antitank rockets. (Page 2-26)

CAUTION

The kHz dial control is a vernier type of dial. Do not spin this dial to gain faster movement over the kHz band. When approaching either the 000-kHz or the 999-kHz reading, fast movement will bend stop clutch, resulting in continuous spinning. (Page 3-21)

CAUTION

Do not attempt to change tape speed until after power is applied and the capstan is rotating. The speed change mechanism may jam if this precaution is not observed. (Page 3-28)

CAUTION

To prevent accidentally entering the record mode and thus erasing the tape, be sure the RECORD SELECTOR switch on each electronic assembly is in the SAFE position. (Page 3-30)

CAUTION

When using a fast-winding mode, do not press the stop and play pushbuttons in such rapid sequence that tape motion cannot stop before the capstan idler clamps the tape to the capstan. If tape motion is not allowed to stop before the play pushbutton is pressed, the tape will probably be broken or stretched. (Page 3-30)

WARNING

Operation of this equipment involves voltages which are dangerous to life. Do not service or adjust the teletypewriter set while it is running unless extreme caution is used, and an assistant is present. (Page 3-32)

WARNING

The radio intercept facility utilizes voltages which are dangerous to life. Do not service or clean equipment when energized. (Page 4-2)

WARNING

Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. Do not use near a flame. (Page 4-2)

CAUTION

Do not press on the meter faces (glass) when cleaning; the meter may be damaged. (Page 4-2)

CAUTION

Care should be taken to ensure that tape guide lubricant does not come in contact with capstan or pinch roller. Should such an accident occur, remove the substance immediately and thoroughly with isopropyl alcohol. (Page 4-3)

CAUTION

Do not over-lubricate. Apply oil sparingly, and carefully wide off all excess oil. (Page 4-4)

CAUTION

Lay the mast carefully on the ground to avoid damaging antenna elements and antenna pedestal. (Page 4-7)

CHAPTER 1

DESCRIPTION OF SYSTEM

SECTION I

GENERAL DESCRIPTION

1-1. INTRODUCTION AND SCOPE.

This manual covers the description, specification data, preparation for use, and operating and maintenance instructions for the Radio Intercept Facility, AN/TSQ-54A. It also serves as a source guide for operating checks, troubleshooting, and operating under special conditions. The Radio Intercept Facility, AN/TSQ-54A, pictured in figure 1-1, will hereafter be referred to as the "radio intercept facility".

1-2. DESCRIPTION: GENERAL, PHYSICAL, AND FUNCTIONAL.

1-3. GENERAL DESCRIPTION. The radio intercept facility electronics equipment is contained in an enclosed windowless shelter mounted on a 2½-ton truck chassis. Several antenna configurations support the electronic equipment (see figure 1-1). The radio intercept facility receives its electrical power from commercial or generator sources. It does not possess or contain power generating equipment. The radio intercept electronics equipment operates from a fixed position and cannot normally be operated while mobile. It has uhf (ultra-high frequency), vhf (very high frequency), and hf (high frequency) capability. A 1½-ton trailer (not supplied with the radio intercept facility) may be used for storage and transportation for the antennas, masts, and accessories.

1-4. PHYSICAL DESCRIPTION.

a. The radio intercept facility (see figure 1-2 for interior view) consists of an S-280 Electrical Equipment Shelter which measures 12 feet, 3 inches in length; 7 feet feet, 3 inches in width; and 6 feet, 11 inches in height. The shelter is helicopter transportable.

b. The shelter houses three distinct (yet operationally integrated) sets of equipment consoles as shown in figure 1-2. Two of the console sets, each consisting of two identical operator positions and one common equipment rack, compose the four available operator positions. A typical console set and common equipment rack (with all components highlighted) is shown in figure 1-3.

c. The third console set (figure 1-4) is the supervisor's position. The supervisor can monitor the operator's intercept signals, maintain typewritten logs, copy sample signals, and establish low-level intercom contacts with any or all operators, as will be discussed under section II, paragraph 1-13 of this chapter.

d. In addition to the signal intercept, recording, and monitoring devices (as highlighted in figure 1-3), the shelter is equipped with a power distribution/control panel located above and behind the supervisor (figure 1-4), and a high-, low-, and blackout-intensity lighting system, controlled by a dimmer switch located above the door.

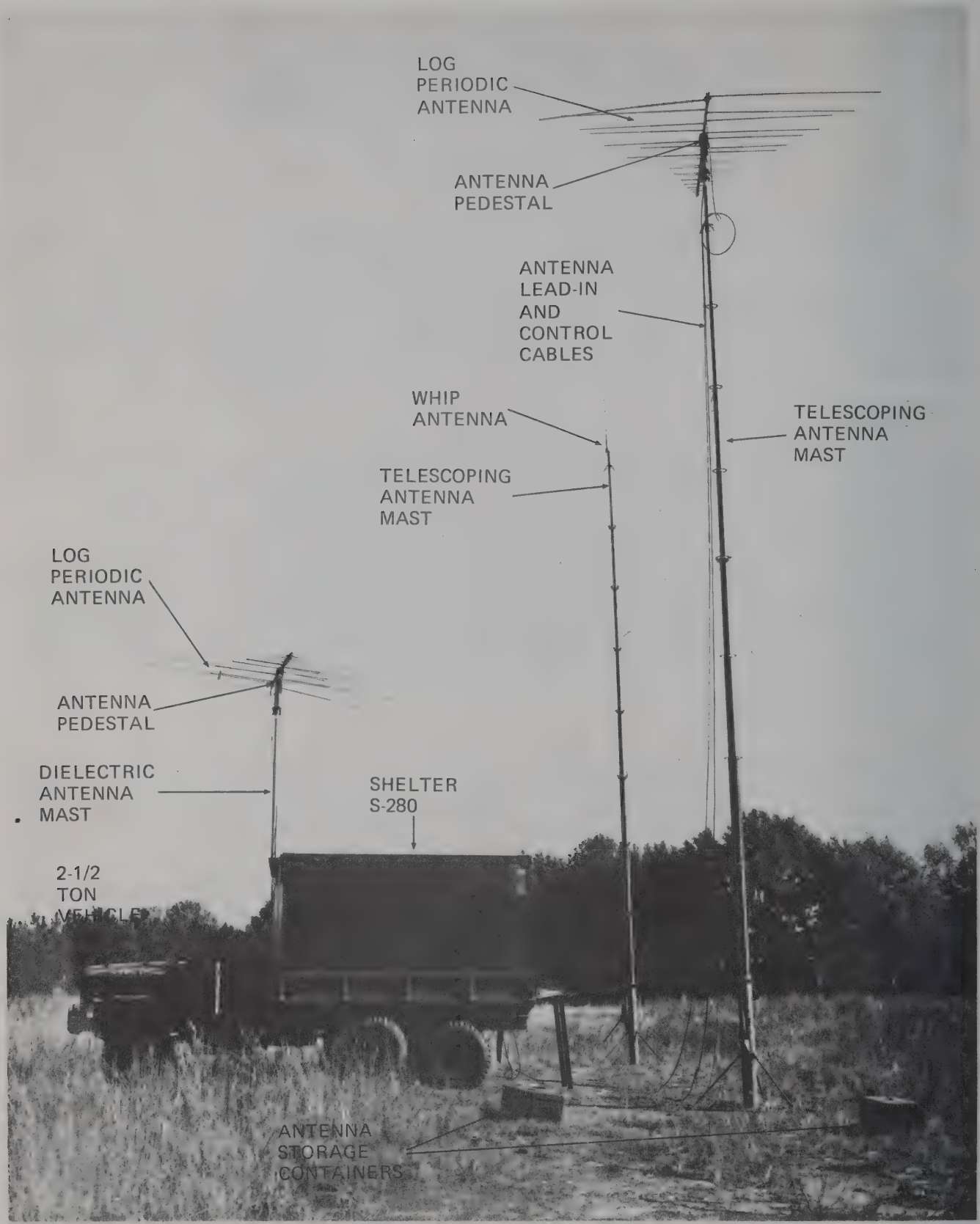


Figure 1-1. Radio Intercept Facility, AN/TSQ-54A, Typical Installation

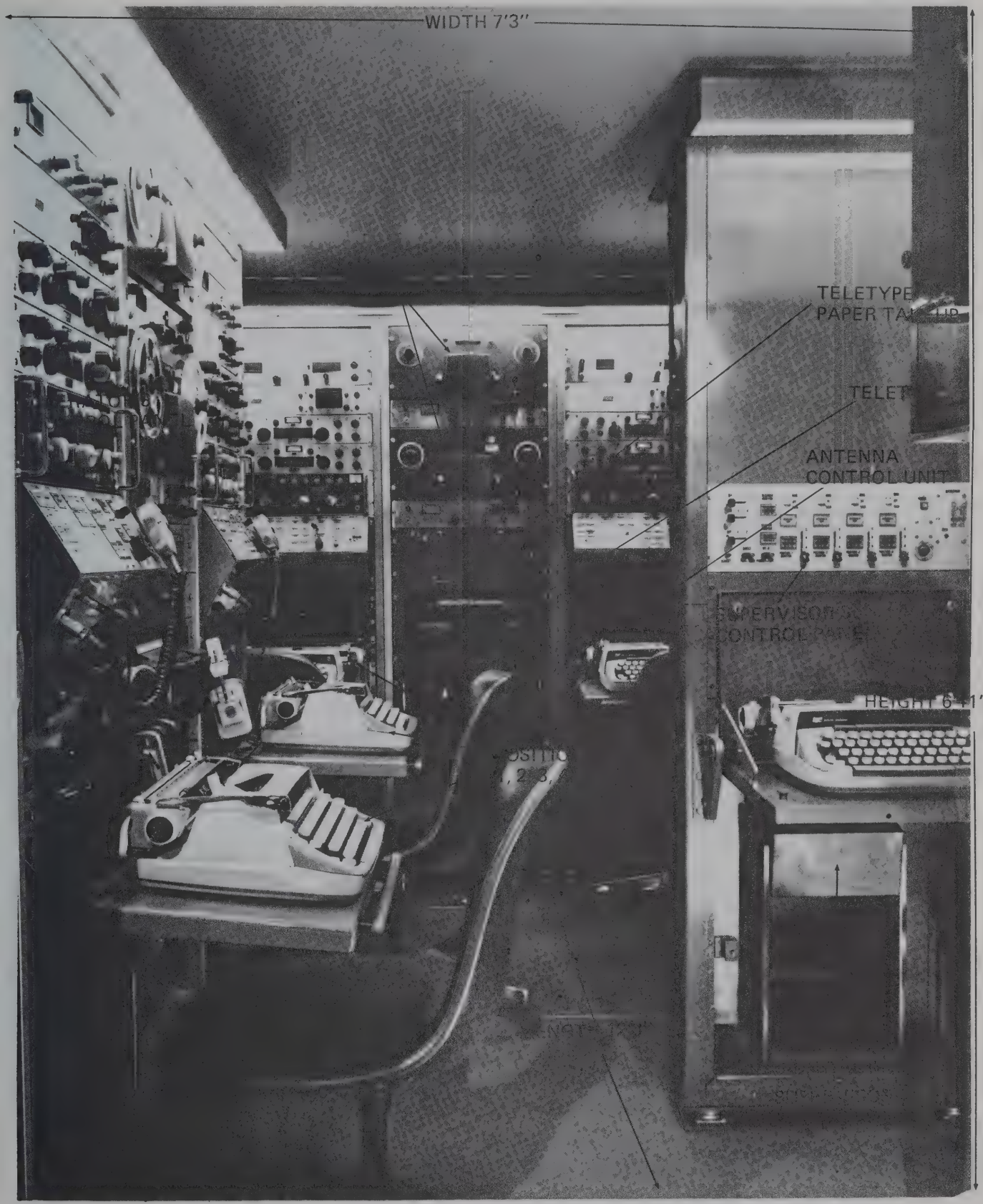


Figure 1-2. Interior View, AN/TSQ-54A

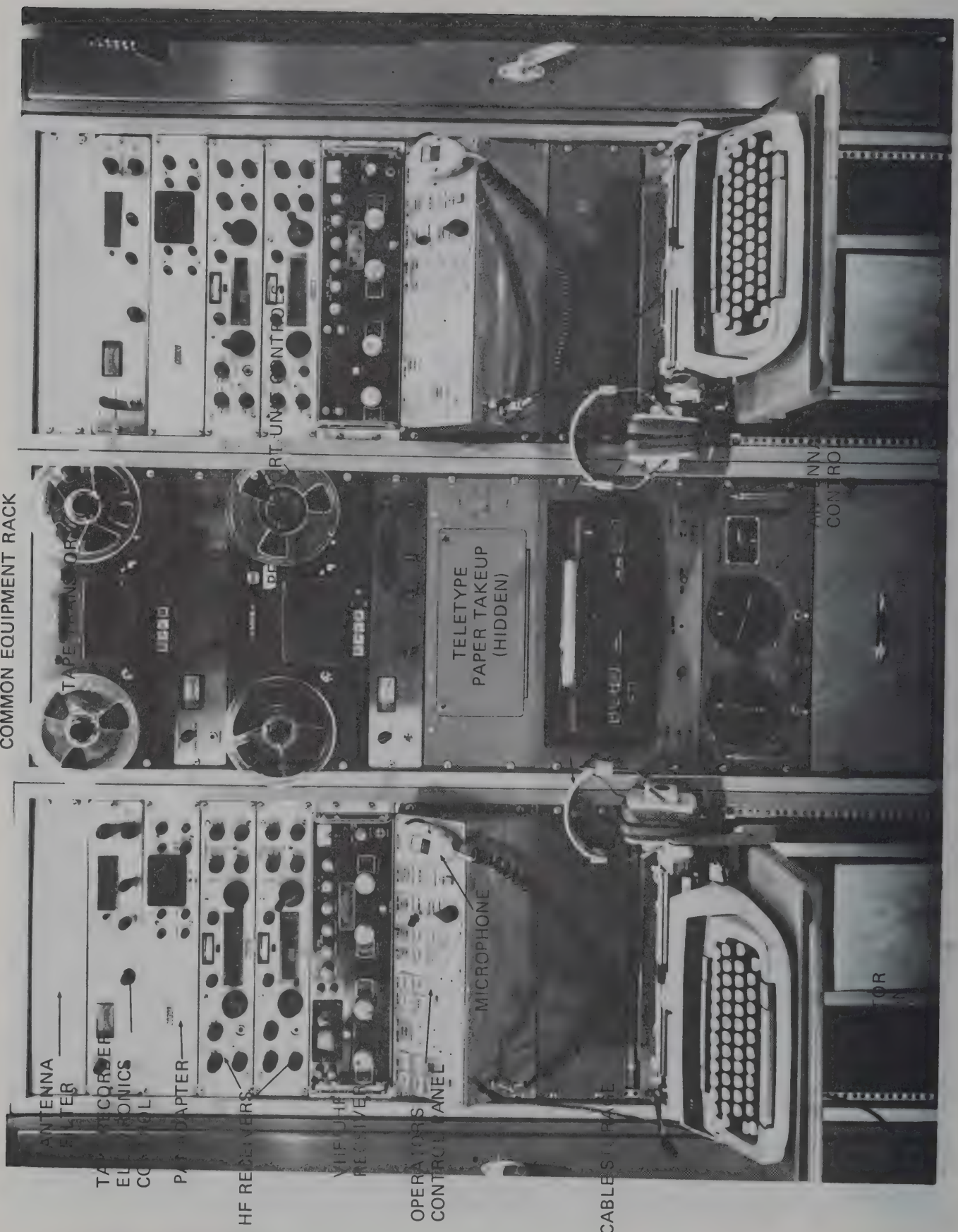


Figure 1-3. Console Set, AN/TSQ-54A

Figure 1-4. Supervisor's Position

1-5. FUNCTIONAL DESCRIPTION. The radio intercept facility equipments perform seven major functions:

a. Monitoring Signals by Radio Receiver. Each receiver console contains two hf receivers and a single vhf/uhf receiver (figure 1-3). The hf receivers provide digital displays of the received frequency. Automatic continuous tuning and an electronic switching feature increase reliability, speed, accuracy, and receiver sensitivity. Associated with the hf receiver is an antenna filter which appears as a blank panel near the top of each operator's console when viewed from the front. The vhf/uhf receiver is distinctive in that it has a built-in spectral display on the top left of the front panel of the receiver (figure 1-3).

b. Evaluating Signals by Electronic Spectral Display. The frequency spectrums of all signals received by both hf receivers and the vhf/uhf receivers can be displayed on a crt (cathode ray tube). The vhf/uhf receiver has a built-in panoramic display (left center panel of figure 1-3); the two hf receivers share a single panoramic display indicator mounted on a separate panel (upper left of figure 1-3). However, only receiver A (upper hf receiver) is permanently hooked up with the associated panoramic display indicator. Signals intercepted by receiver B (lower hf receiver) can only be displayed by tuning receiver A to the signals picked up by receiver B. The panoramic display indicator (normally called a panadapter) is an automatic scanning device with superheterodyne receiver circuits which permit many rf (radio frequency) signals to be analyzed simultaneously. Panadapters are usually connected through isolating circuit elements to the output of the mixer in a receiver. Their physical location may vary from one radio intercept facility to another.

c. Recording Signals on Audio Tape or by Teleprinter. Operators can record signals on magnetic audio tape or by teleprinter. The two common equipment racks (figure 1-3 shows one) house all equipment for signal recording except the Tape Recorder/Reproducer, AG-500-2, which is the uppermost unit visible in each operator's position (shown in figure 1-3). Two tape transport assemblies (each with two reels, tape travel controls, capstan, and head assembly) are located immediately above their electronics control units in the common equipment rack. A vu (volume unit) meter is a distinguishing element of the tape recorder electronics control. A teletypewriter is mounted on drawer slides and normally rests in the recesses of the equipment rack (figure 1-3).

d. Intercepting Signals with Antennas. Antennas with their associated masts, rotators, and controls provide for the interception of radio signals (figure 1-1). Prior to operational installation, the two telescoping antenna masts and antennas are boxed in specially designed cases that are transportable by a 1½-ton trailer (not supplied with the radio intercept facility). Two antenna pedestals (rotators) for use with log periodic antennas are stored inside the shelter against the right wall to the rear of the supervisor's position (figure 1-4). The wall area between operator position number four and the air conditioner (figure 1-4) allows space for storing the interlocking dielectric antenna masts used to install the search antenna on the front of the shelter (shown installed in figure 1-1). The lower part of the common equipment rack (figure 1-3) houses a remote antenna-control unit used for selecting both the polarization and azimuth of each log periodic antenna. Three antenna configurations are normally used with this radio intercept facility: rotary directional beam, vertical omnidirectional whip, and a long wire (not discernible in photos). An electro-mechanical antenna coupler (discussed later in paragraph 1-15) is located in a cabinet above and forward of the supervisor's position (figure 1-4). All hf receivers are normally attached to a single whip antenna visible in

figure 1-1. The log periodic antennas used with the vhf/uhf receivers are discussed later in paragraph 1-17).

e. Supervisory Interchange. As previously noted, the radio intercept facility comes equipped with a supervisor's control/monitor located in the right rear of the shelter (figure 1-4). This control/monitor permits the supervisor to talk to the operators by intercom and to listen in on their monitoring and taping activities. The supervisor has no direct control over the operators' signal selections and operations. However, he can make his presence known to them by intercom signal.

f. Conditioning of the Environment. Since the intercept facility is normally operated with the shelter door closed, a means for ventilation, heating, and cooling is required. A light weight, self-contained air conditioning unit (shown in figure 1-4 and in close-up in figure 1-5) is provided with each shelter. Other compatible air conditioners are shown in the current edition of TM-4120-15/1.

g. Power Provision for Operation. The radio intercept facility equipment operates from either a commercial or motor-generator power source. Both dc (direct current) and 110- and 220-vac (volts, alternating current) power is required. All electronics equipment, except antenna coupler, uses 110 vac whereas the air conditioner requires 220-vac. A rectifier located inside the power panel (as shown in figure 1-4), provides the required 28-dc (volts, direct current) power. All power, signal, and communication lines enter the shelter through a cable terminal located to the right of the shelter door (shown in figure 1-6). Since more than one radio intercept facility may be operated from the same power source, each shelter has a power-looping circuit, which cannot be interrupted by a switch in the power distribution panel. Power enters the shelter via one set of plugs and leaves via another set of plugs. Thus, special power cables can interconnect two or more shelters operating from a common power source.

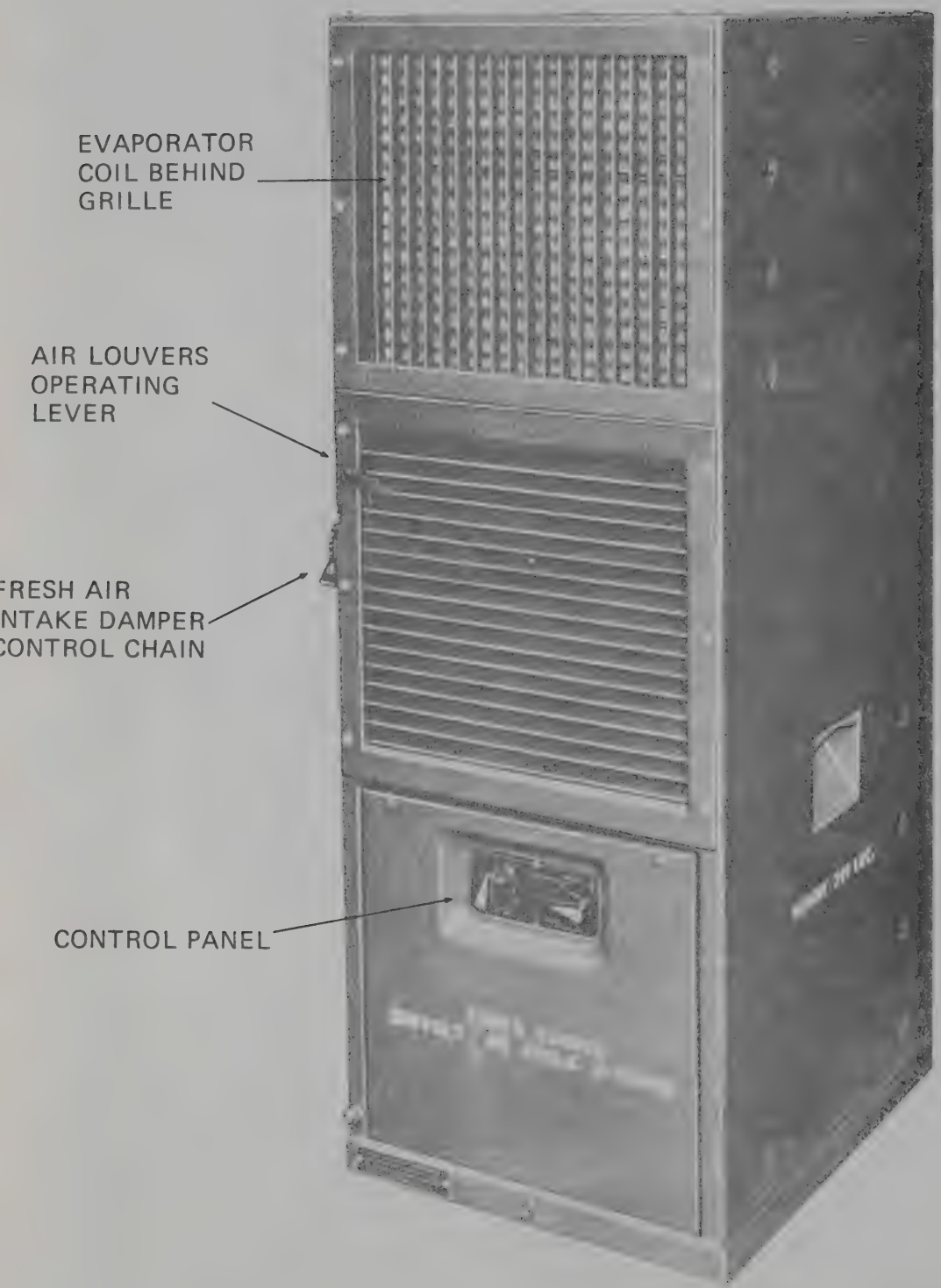


Figure 1-5. Type A/E32C-17 Air Conditioner

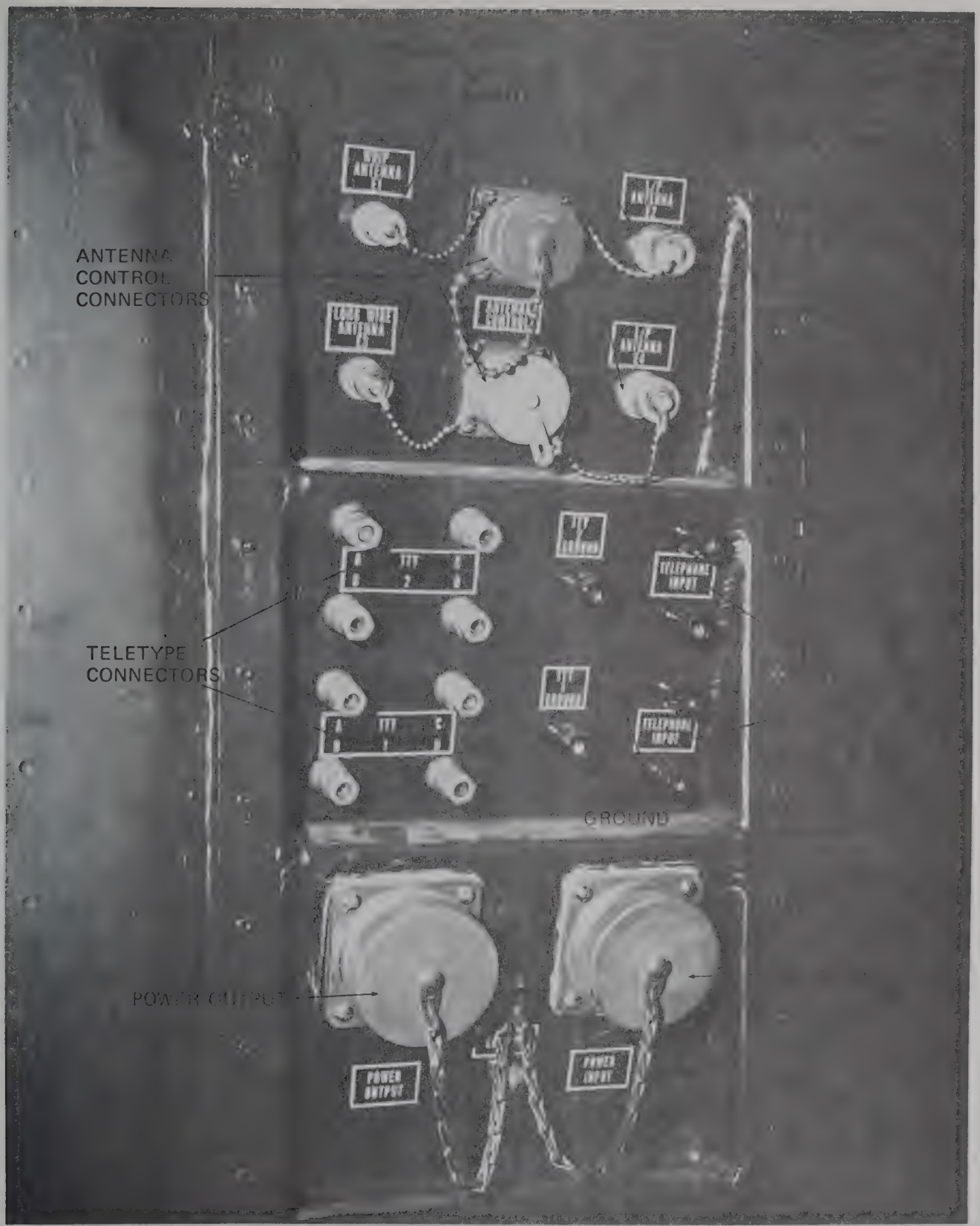


Figure 1-6. Cable Terminal, AN/TSQ-54A

SECTION II

SPECIFICATION DATA

1-6. PHYSICAL AND TECHNICAL CHARACTERISTICS OF MAJOR UNITS OF EQUIPMENT.

1-7. HIGH FREQUENCY RECEIVER. The High Frequency Receiver, RA6217E (shown mounted in console position in figure 1-3 and close-up in figure 1-7) is a solid-state, general-purpose receiver capable of receiving radio frequency unmodulated cw (continuous wave), am (amplitude modulation), fm (frequency modulations), mcw (modulated continuous wave), and ssb (single sideband) signals over a frequency range of 980 kHz (kilohertz) and 30 MHz (megahertz). Located behind a blank panel above the hf receiver and near the top of the operator's console (uppermost in figure 1-3) are the RA6397A Antenna Filters (preselectors) that are connected to the hf receiver antenna terminals. See figure 1-8 for a rear-panel view. The antenna filter eliminates antenna tuning and provides immediate, automatic preselection in accordance with the frequency setting of the receiver. It increases receiver selectivity through out-of-band signal attenuation by as much as 30 db (decibels). The linear characteristics of the passband response makes this unit ideal for panoramic reception application. The unit consists of a bank of 21 pretuned bandpass filters, each about 1-MHz wide in the low frequency ranges, and 5-MHz wide above 20 MHz. (See figure 1-9 for interior view and highlight of parts.) Selection of a particular filter is accomplished by means of reed relays actuated by dc voltages applied through a 30-position switch mechanically connected with the receiver MHz tuning control. The 30 switch-positions in the receiver agree closely with the 00 through 29 MHz tuning ranges. Filters in the antenna preselector are activated through a control line filter assembly, terminated in a 20-pin connector, and wired to a jack (J3401) on the rear panel of the hf RA6217E Receiver (figure 1-10). Other connectors on the rear panel of the hf RA6217E Receiver (rf input, audio output, control, and access terminals) are shown in figure 1-10 and are further described in the technical characteristics tables. See tables C-1 and C-2, for technical characteristics.

1-8. PANORAMIC DISPLAY, RA6502A. The Panoramic Display Indicator, RA6502A (shown mounted in figure 1-3 and close-up in figure 1-11) is commonly known as a panadapter. It is called an RA6366 when panel mounted. It provides a visual display of signals in any selected frequency band lying between 980 kHz and 30 MHz. The panadapter should be regarded as three subunits on one chassis: one rf signal channel, an if (intermediate frequency) signal channel, and the calibration marker circuits plus the dc-to-dc converter (high voltage power unit) necessary to operate the crt. The frequency of the panadapter is varied between established limits so that it selectively sweeps a given band of frequencies. The maximum spectrum width that can be viewed with this panadapter is 1 MHz using the rf mode. The spectrum that can be viewed in the if mode of the panoramic display is determined by the if switch position on the hf receiver. In either mode of operation, however, the displayed spectrum can be expanded to permit extra close inspection of the selected signal that is to be displayed. All power and control voltages are taken from the hf receiver, except for the high voltage on the cathode ray tube. See table C-3, for technical characteristics of the RA6366 Panoramic Display Indicator.

1-9. VHF/UHF DISPLAY RECEIVER, AN/URR-52A. The Receiving Set, Panoramic Data, AN/URR-52A (shown mounted in upper left of figure 1-3 and close-up in figure 1-12) is commonly known as a vhf/uhf receiver. It provides a visual display of am, fm, and cw signals received over the 30- to 1000-MHz range. The vhf/uhf receiver has

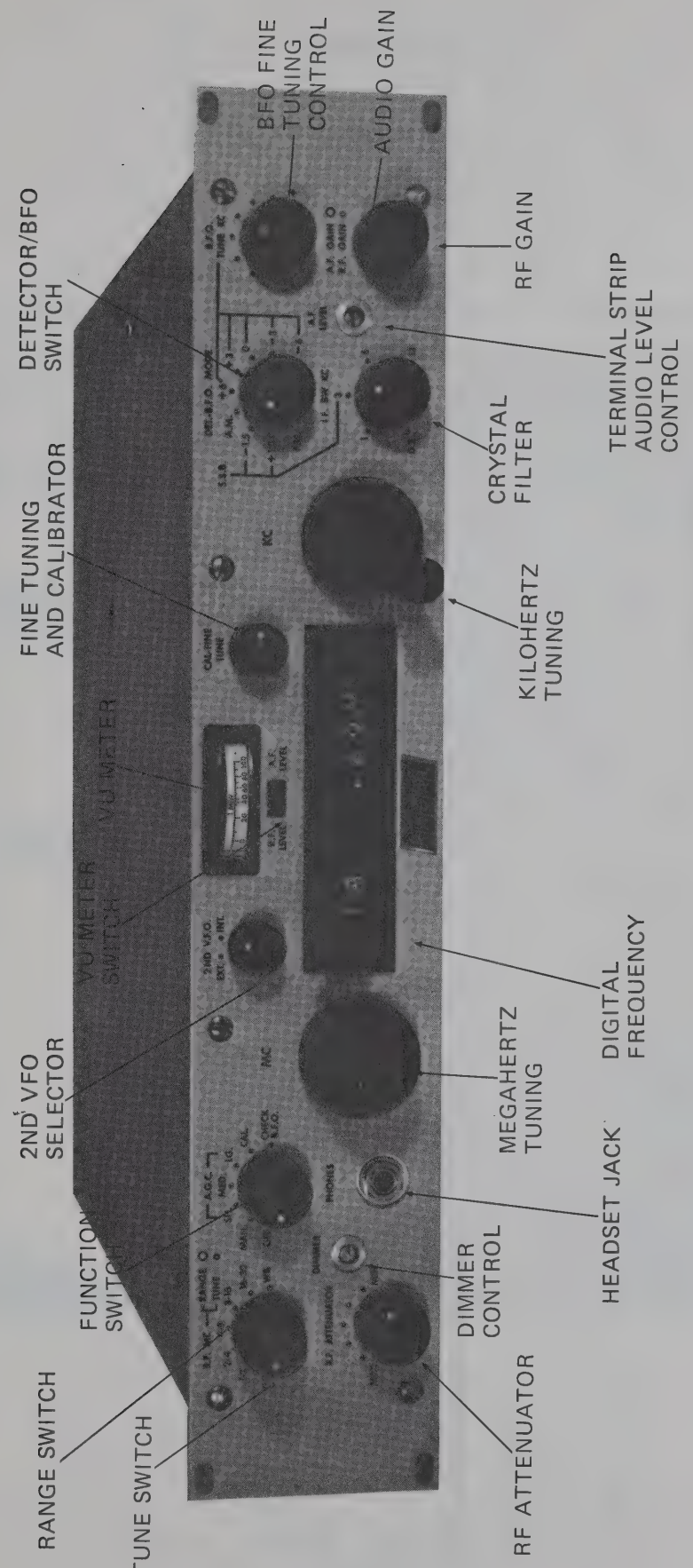


Figure 1-7. High Frequency Receiver, RA6217E

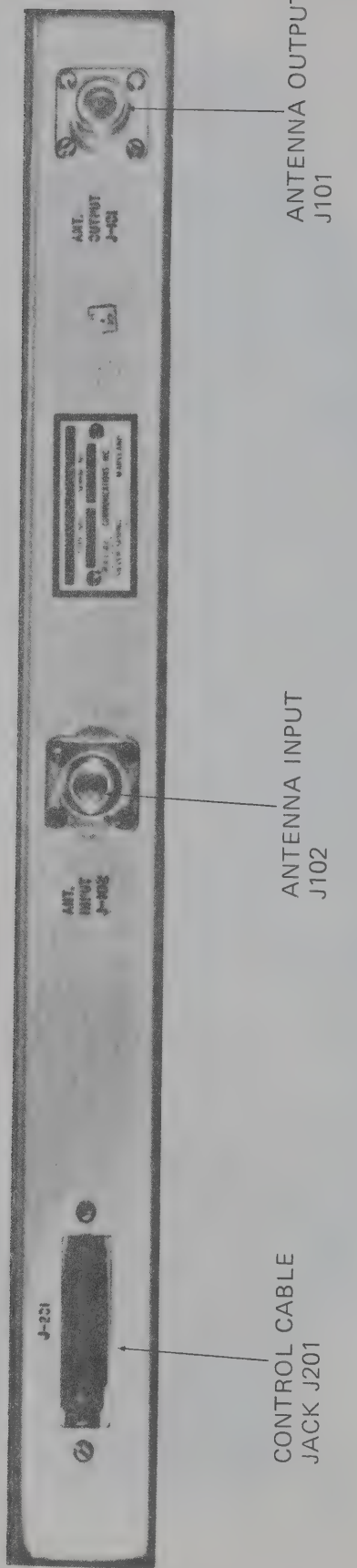


Figure 1-8. Antenna Filter, RA6397A, Rear Panel View

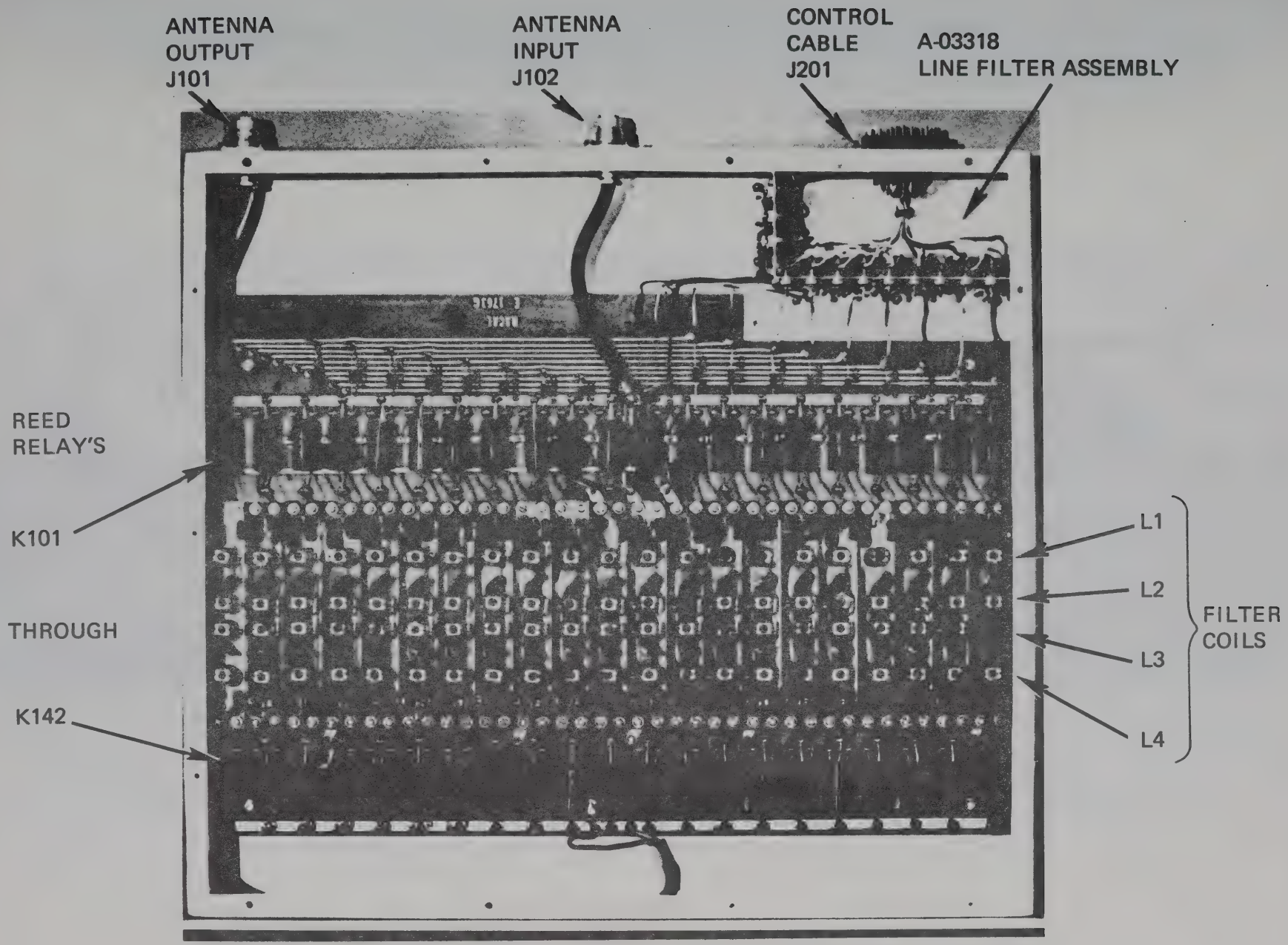


Figure 1-9. Antenna Filter, RA6397A, Interior View

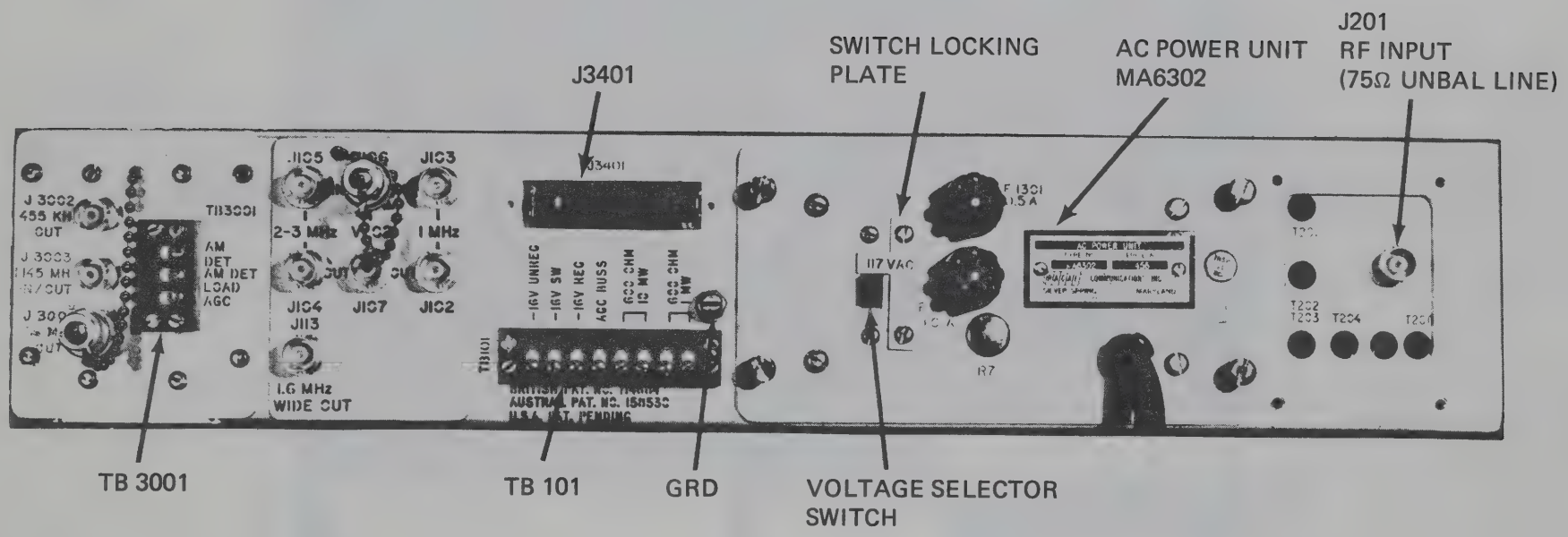


Figure 1-10. High Frequency Receiver, RA6217E, Rear Panel View

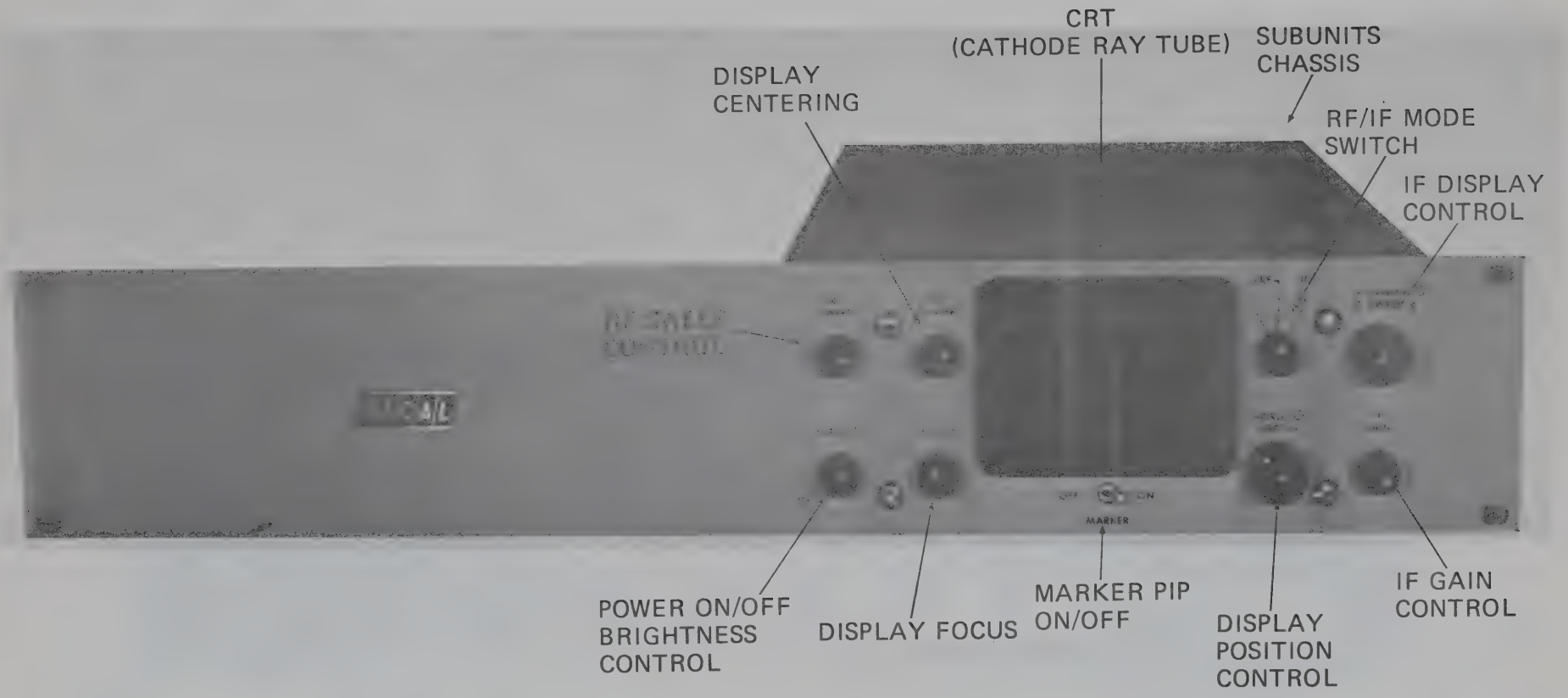


Figure 1-11. Panoramic Display Indicator, RA6502A (RA6366 When Panel Mounted)

TM-03844B-10

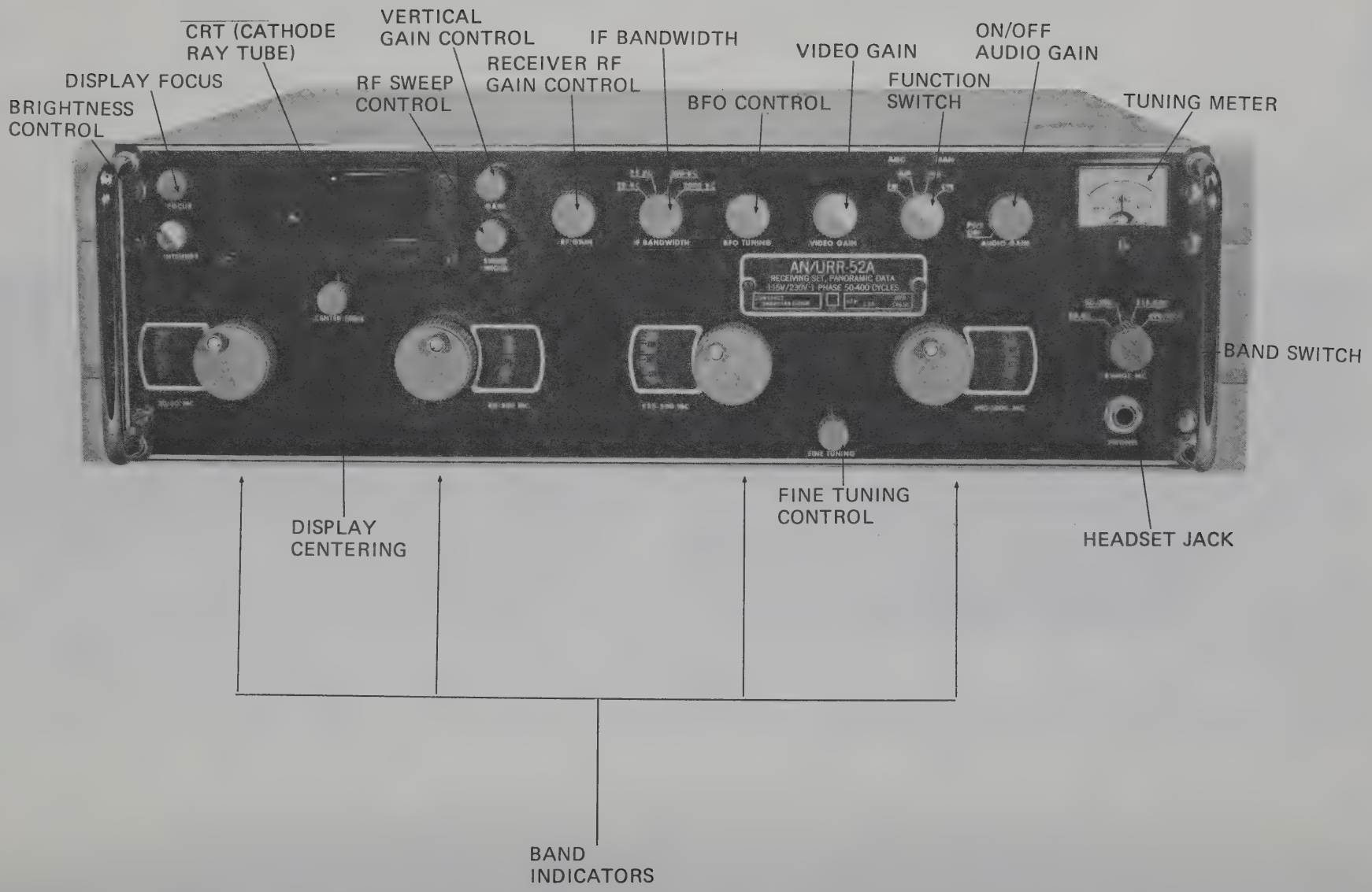


Figure 1-12. VHF/UHF Receiving Set, Panoramic Data, AN/URR-52A

four discrete bands ranging from 30 to 60 MHz, 60 to 300 MHz, 235 to 500 MHz, and 490 to 1000 MHz. There are two if bandwidths in operation at all times: a 2-MHz bandwidth if strip with simultaneous am video outputs and another if bandwidth which is either 20 kHz, 75 kHz, or 300 kHz (depending on the setting of the front-panel IF BANDWIDTH switch). A common video output (OUTPUT-AM-FM-VID) is available from this strip depending on the setting of the front-panel function switch. The 20-kHz, 75-kHz, 300-kHz if bandwidth strip contains a bfo (beat-frequency oscillator) which operates in the CW position of the function switch on all three bandwidths. A single FINE TUNING control provides vernier tuning on the tuner in operation; but switching of the four tuners is controlled by the RANGE MC switch on the front panel. Visual display of the singals is provided by a signal monitor which is an integral part of the receiver. As shown in figure 1-12, the front panel of the vhf/uhf receiver contains four major tuning dials and knobs (in addition to FINE TUNING, AUDIO GAIN, VIDEO GAIN, BFO TUNING, and RF GAIN controls); two function switches (RANGE and IF BANDWIDTH); one PHONES jack; and a tuning meter. These controls, switches, and indicators are primarily associated with the receiver functions of the unit. The front panel additionally contains GAIN, SWEEP WIDTH, CENTER FREQ., INTENSITY, and FOCUS controls which are associated with the signal monitor section of the receiver. A rectangular crt screen is also installed in the front panel. The AUDIO output at 600 ohms is provided from terminal strip TB1. The ac line fuses are installed on the rear apron along with a 115-V/230-V power switch. The power cord is a quick-disconnect type. More complete technical characteristics appear in table C-4.

1-10. AUDIO TAPE RECORDER, AG-500-2. The radio intercept facility is equipped with a two-track, dual-channel, two-speed, tape recorder/reproducer for each operating position. The relay-operated tape transport (shown mounted in upper center of figure 1-3 and close-up in figure 1-13) consists of two 7-inch reels, a standard tape movement and control mechanism, a triple-head assembly under a cover that can be elevated fully for tape threading, and one dual input solid-state electronics assembly, AG-500-2 (shown mounted in figure 1-3 and close-up in figure 1-14) for each record/reproduce operating channel. One-quarter inch audio tape permits the simultaneous recording of received signals and operator comments. Each electronic assembly is a complete record/reproduce channel capable of accepting and mixing two incoming signals controlled by discrete input/output level controls. It also features an illuminated vu meter that can be switched to register either the record or reproduce levels, and a phone jack for audio monitoring of both the input and output signals. Remote start/stop foot pedal control (Linemaster 634-D) provides control of recorders from the operator's position. Refer to table C-5, for major specifications.

1-11. TELETYPEWRITER SET, AN/TGC-14A(V). Teletypewriter set, AN/TGC-14A(V), (shown mounted in center of figure 1-3 and close-up in figure 1-15) is a rugged, lightweight, miniature, alphanumeric-printing telegraph set adapted to the radio intercept facility for use under a wide range of operating conditions. The teletypewriter set is fully compatible with other commercial and military teletypewriter equipment employing the standard Baudot code and can monitor existing radio-link communications systems. Even though the primary purpose of the teletypewriter is to monitor, it can, by appropriate signal patching and switching, be operated in either half-duplex (simplex) or full-duplex on- and off-line circuits. Patching facilities are also provided to allow off-line local operation as an electric typewriter or for local testing. As figure 1-15 illustrates, the teletypewriter set is furnished in a special shock-mounted tactical case for field and mobile use. The teletypewriter employs a standard teletypewriter keyboard which, when the set is in the transport

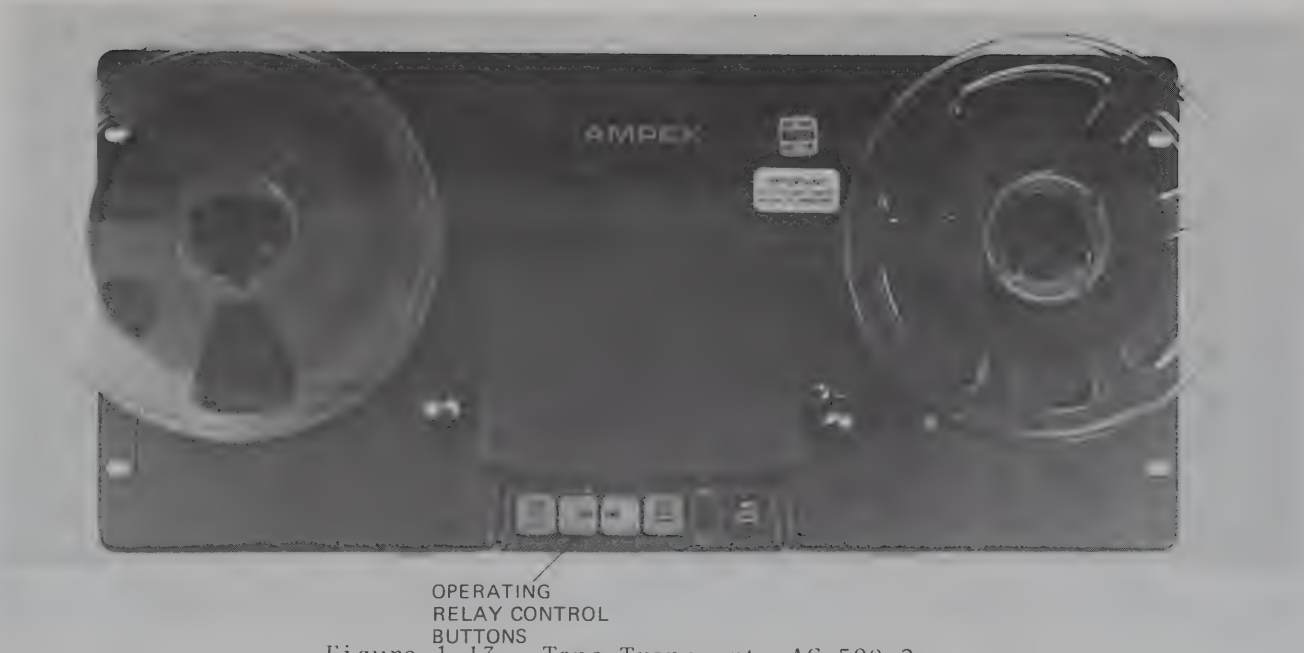


Figure 1-13. Tape Transport, AG-500-2

Figure 1-14. Electronics Unit, Tape Recorder/Reproducer, AG-500-2

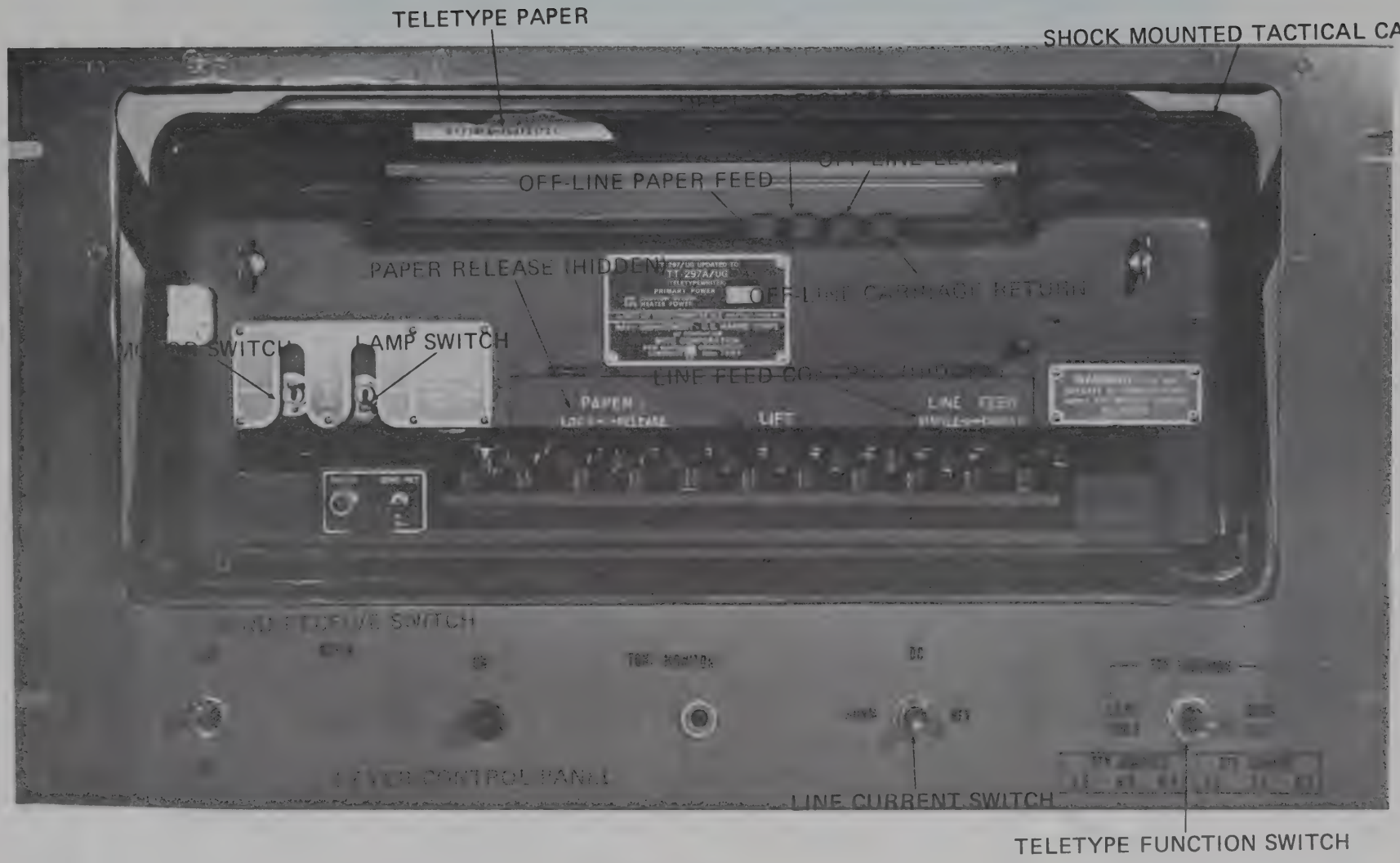


Figure 1-15. Teletypewriter Set, AN/TGC-14A(V), With Keyboard in Stowed Position

attitude, may be stowed in a recess in the electrical chassis beneath the printer. The teletypewriter proper consists of a keyboard and an electrical chassis. The electrical chassis consists of an electrical printing unit, a copy-paper holder, a signal-line power supply, and a line sensor. Both the keyboard and the electrical chassis are contained in a single tactical case. See figures 1-15, 1-16, and 1-17. A take-up reel located behind a drop-lid panel above the teletypewriter receives the printed teletypewriter paper output. See figures 1-2 and 1-3. The KY-463A/FGC Tone Demodulator/Keyer (figure 1-16) is installed behind the teletypewriter. This method of positioning components permits access on one chassis to the service cable receptacle through which all power, signal line, and ground connections are made. To the right of the service cable receptacle are five fuses, seven option patching jacks, and a line-adjust rheostat. See figure 1-17. Technical characteristics are contained in table C-6.

1-12. OPERATOR'S CONTROL PANEL. The operator's control panel (shown mounted in center left of figure 1-3 and close-up in figure 1-18) is located at a slight angle directly in front of each operator. From this panel, the operator can switch, transfer, monitor, print, and record specifically selected radio signals. To provide the best possible signal, he has the option of activating an antenna selecting feature, giving him access to one or more antenna configurations. Since the operator has only a single hand-held microphone, the operator's panel provides for a switching capability from audio tape to intercommunication. In the event that an operator desires to signal another operator (or his supervisor), he can generate an intercom ringing signal from his position. Most switches in the operator's panel are of the press-to-illuminate type. Exceptions are the Recorder-1 and Recorder-2 selecting switches and the Foot Pedal Control switch. Figure 1-18 illustrates the panel mounted switches. Use of other switches available to the operator are discussed more fully in paragraph 3-29 of this manual.

1-13. SUPERVISOR'S ACTIVITIES MONITORING PANEL. The supervisor's control panel (shown in figure 1-4 and close-up in figure 1-19) is located next to the right wall of the radio intercept facility van. It provides for monitoring of any operator's position and an intercommunication system to any one or to all of the operators simultaneously. He also has a termination for out-of-the-van telephone communication. From his position, the supervisor is able to manage the complete operation of the radio intercept facility. Since he is aware of the frequency range assigned each operator, and the needs of each operator as to antenna choice and antenna polarization, the supervisor, with his overall knowledge of mission requirements, can efficiently direct collection of information in the most economical manner with maximum efficiency.

1-14. ANTENNA CONTROL UNIT. The Antenna Control Unit, C-7120/G (one of which is shown in lower center of figure 1-3 and close-up in figure 1-20), provides the control voltage for the rotation and polarization, and furnishes the command signals for repositioning the AS-1898/G Log Periodic Antenna (figure 1-1). The dials on the Antenna Control Unit reflect the azimuth and polarization of the antenna. Unlike the other components of the antenna system, this control unit should remain installed inside the van in the common equipment rack (figure 1-3) to prevent exposure to the elements. A 19-conductor cable connects the antenna control unit to the plugs labeled "Antenna Control" on the cable terminal (figure 1-6).

1-15. ANTENNA COUPLER. The Antenna Coupler, CU-1863/FRR, consisting of an rf filter, an rf amplifier, and a hybrid transformer, plus the necessary cable connectors (view B, figure 1-21), is installed in a closed-cabinet type rack forward of the

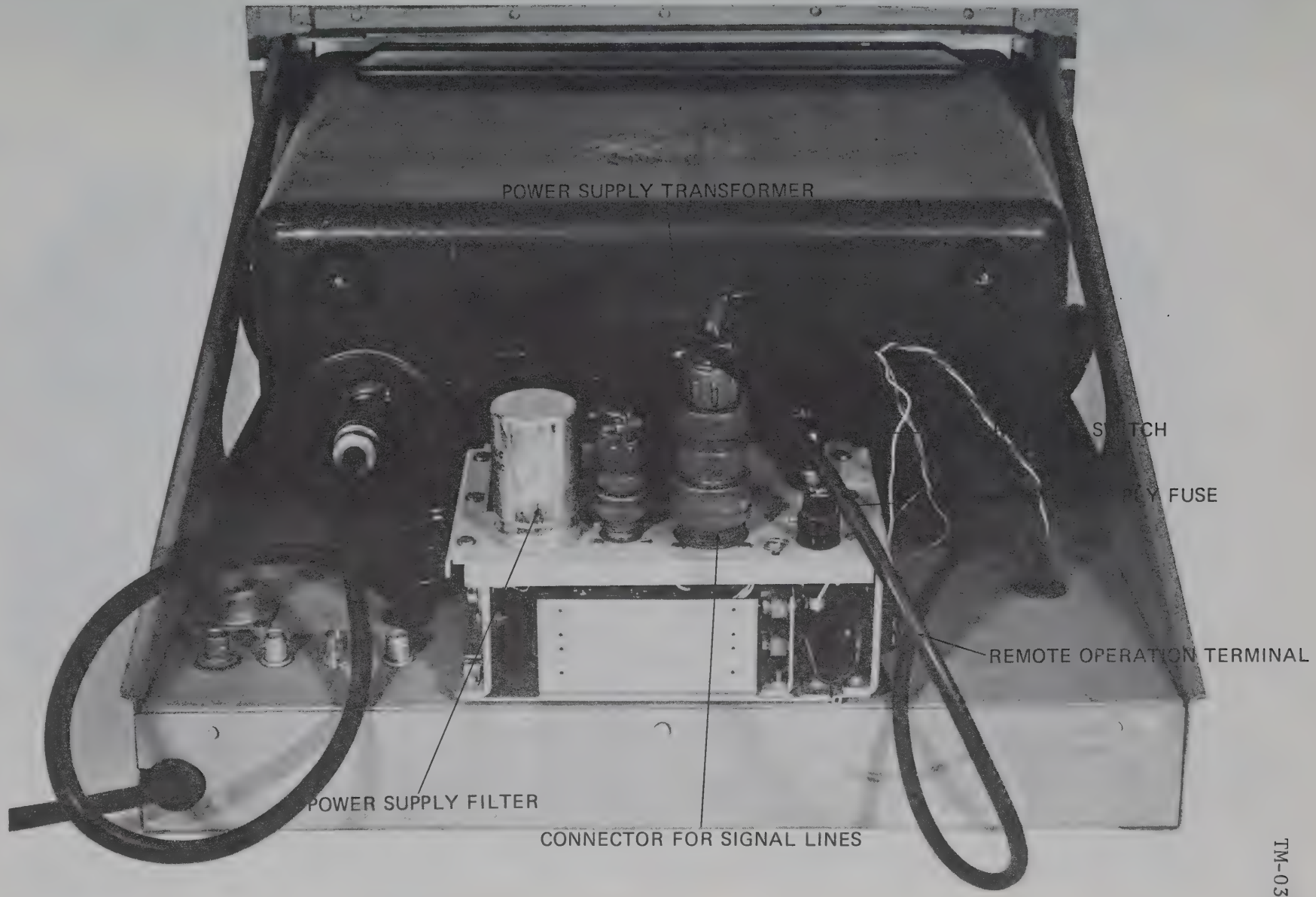


Figure 1-16. Keyer, KY-463A/FGC, Installed Behind Teletypewriter Set Case

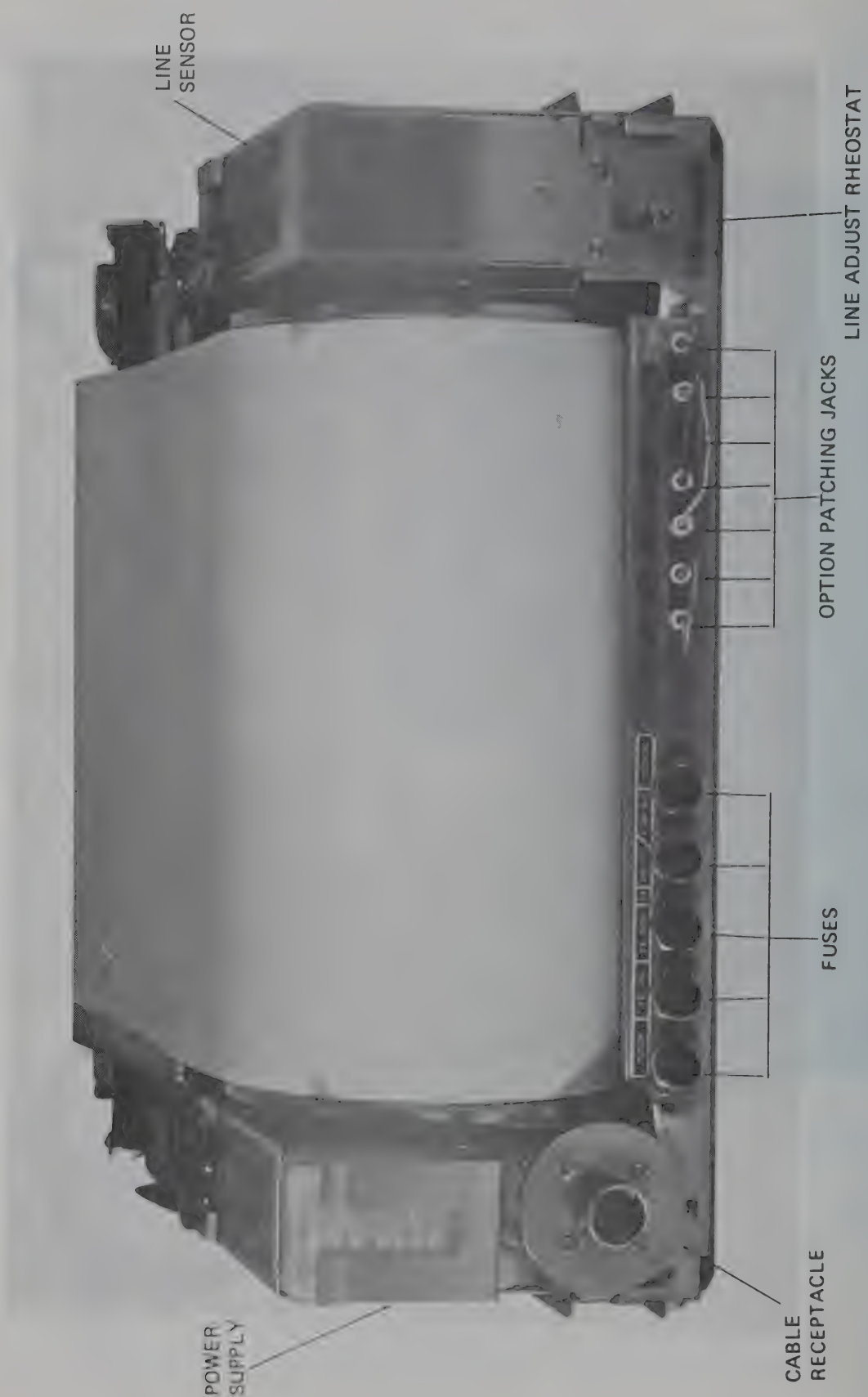


Figure 1-17. Electrical Chassis, Teletypewriter Set, Rear View (Removed from Case)

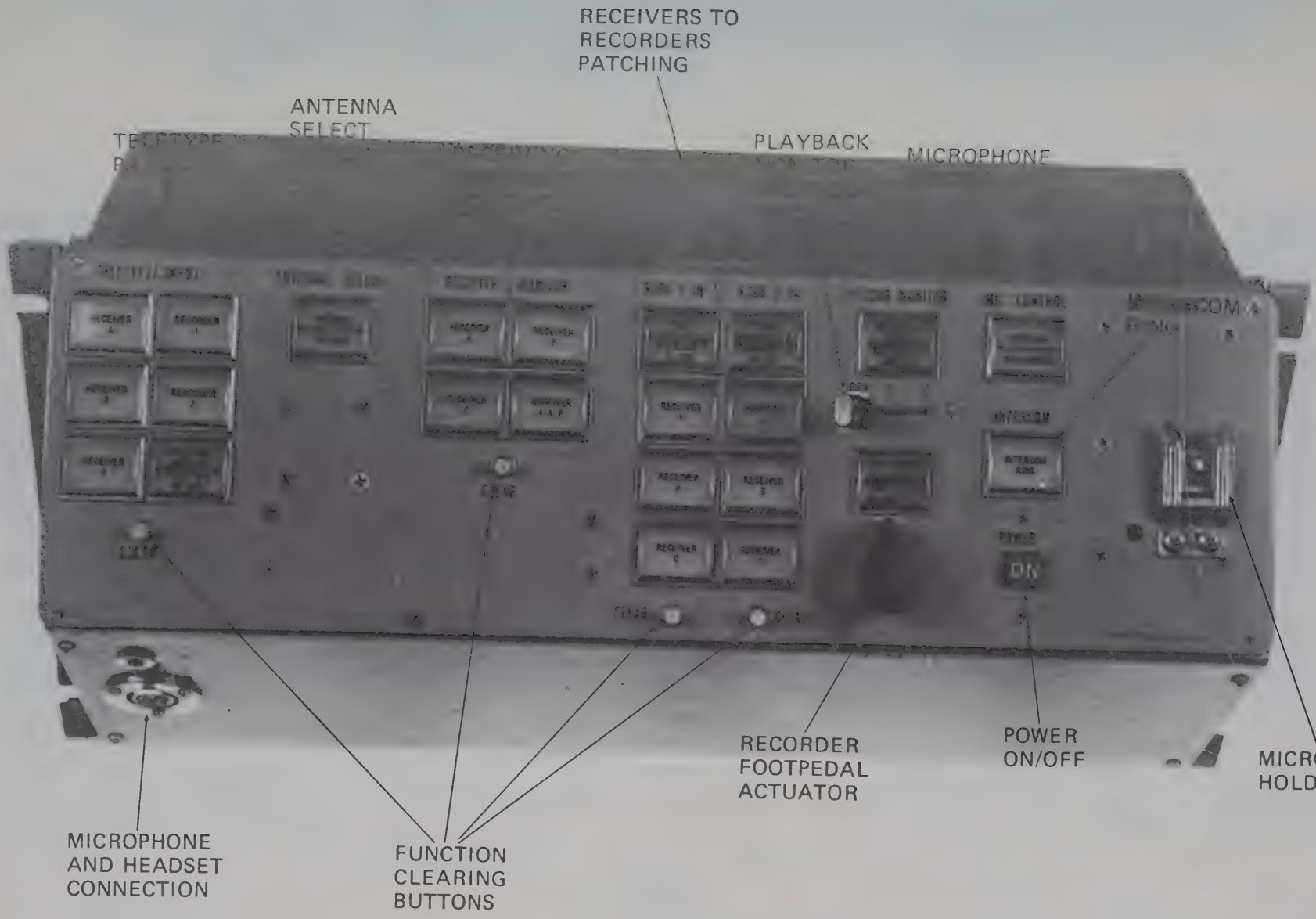
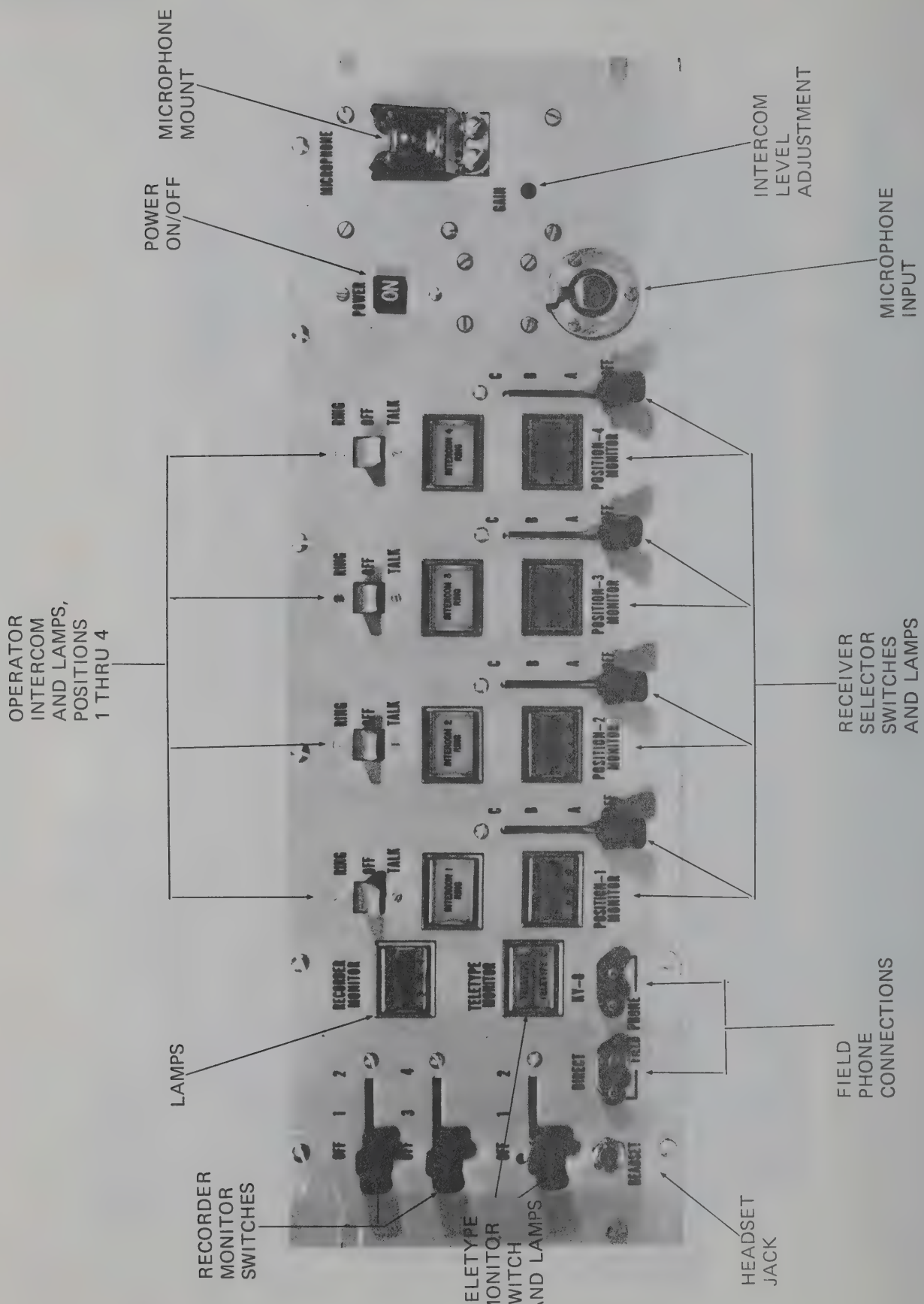


Figure 1-18. Operator's Control Panel


MICROPHONE MOUNT
POWER ON/OFF
INTERCOM LEVEL ADJUSTMENT
MICROPHONE INPUT
OPERATOR INTERCOM AND LAMPS, POSITIONS 1 THRU 4
RECEIVER SELECTOR SWITCHES AND LAMPS
LAMPS
FIELD PHONE CONNECTIONS
RECORDER MONITOR SWITCHES
TELETYPE MONITOR SWITCH AND LAMPS
HEADSET JACK

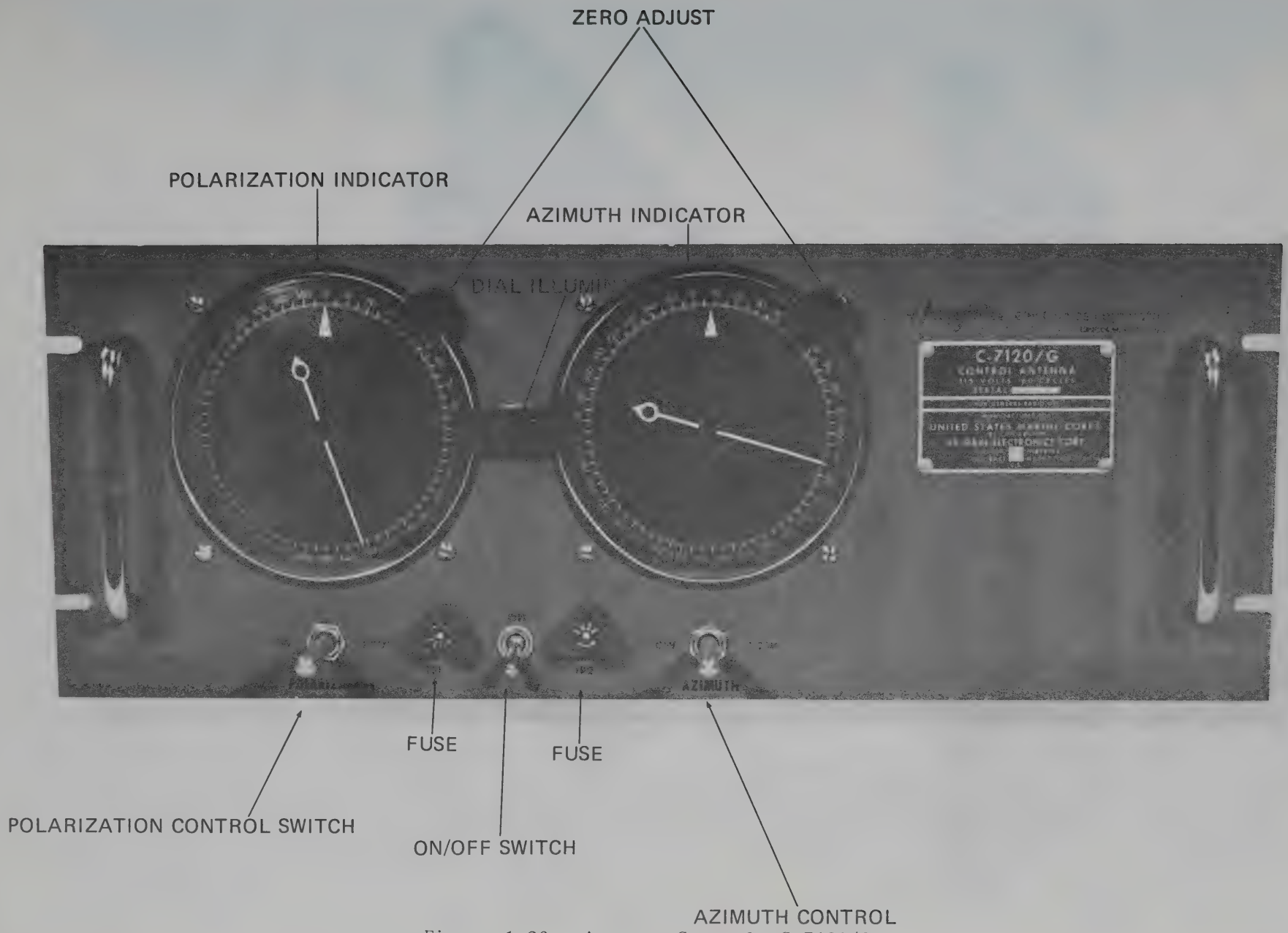
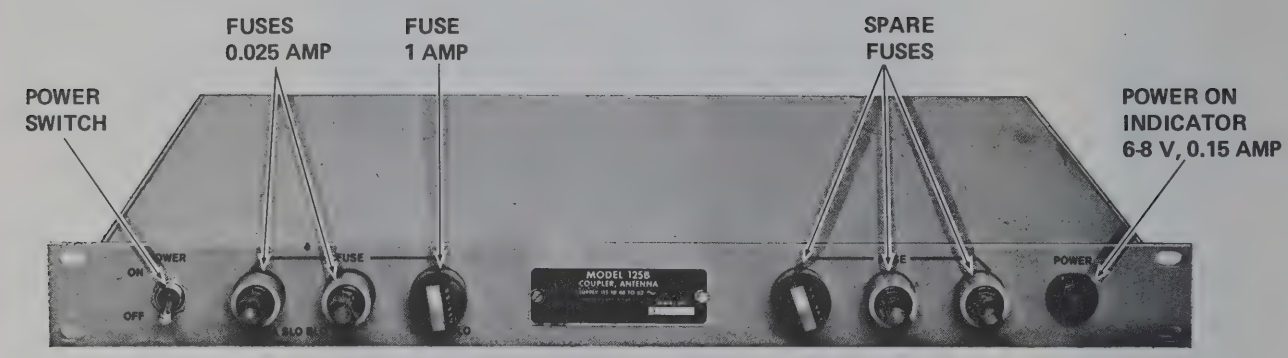
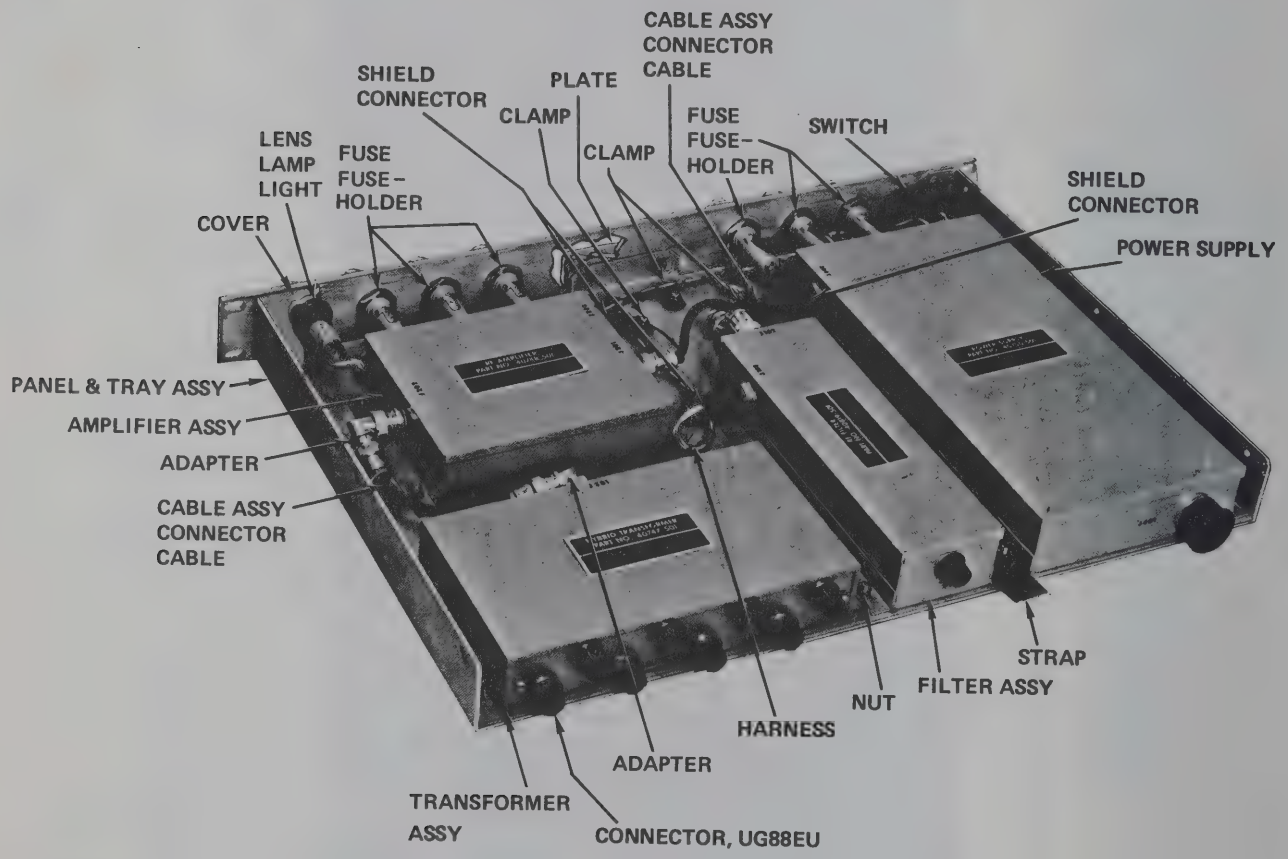


Figure 1-20. Antenna Control, C-7120/G



VIEW A



VIEW B

Figure 1-21. Coupler, Antenna, CU-1863/FRR

supervisor's control panel (figure 1-4). Input/output connections are mounted on the rear of the coupler chassis. (See view B, figure 1-21.) Coaxial cables, routed through a cable duct, connect the hf receivers to the Antenna Coupler, CU-1863/FRR, within the shelter. (See view A, figure 1-21.) The antenna coupler is permanently connected to appropriate connectors on the cable terminal (figure 1-6) physically located to the right of the shelter door. Major characteristics of the antenna coupler are given in table C-7.

1-16. ANTENNA PEDESTAL, AB-991-G. The Antenna Pedestal, AB-991-G (figure 1-22), is a light-weight, small, and compact antenna rotating and tilting device with the capability of moving in both azimuth or polarization. It will mount on any tubular mast having a diameter from 2-3/4 to 3-1/2 inches. As shown in figure 1-1, the pedestal mounts atop the AB-746/U Telescopic Mast. A Log Periodic Antenna, AS-1898/G, mounted on top of the pedestal is secured by two bolts through a bracket (figure 1-23). Technical characteristics for the antenna pedestal are given in table C-8.

1-17. ANTENNA MAST, AB-746/G. The 50-foot telescoping antenna mast (shown to the right in figure 1-1 and in a collapsed close-up in figure 1-24), is designed for supporting any one of a wide variety of antenna configurations, from long-wire through multi-element arrays. This type of mast, intended for use with mobile terminals, provides an optimum combination of light-weight, strength, durability, ease of installation, adjustability, and minimum storage space requirements. The mast is constructed of heat-tempered, extruded-aluminum tubes to provide the highest possible strength-to-weight ratio. Each mast is made up of a tubular base section, eight tubular telescopic sections, and an adapter tube. (See figure 1-25 for base section view.) Long-life, maintenance-free, Teflon bearings are used on all sliding surfaces. The base plate assembly is constructed of lightweight cast aluminum with hinged legs that fold upward. When folded and secured to a circular plate with wing nuts, the legs form a storage case for the mast accessories. All guy lines are 1/8-inch preformed wire rope (aircraft control cable type). Pulleys have aluminum frames and stainless steel (or nylon) sheaves with ball bearings. All mast components, except sliding surfaces and moving parts, are corrosion plated (iridited), then painted olive drab. The mechanical system by which the mast is erected and lowered permits raising or lowering of each telescoping section with a single operation. Provisions are made for automatic guying during erection, latching at maximum mast height, and holding at various height intervals. During erection of the mast, the first four sections extend simultaneously to their limits as the lifting mechanism is operated. When these sections are securely guyed, the remaining four sections may be jacked up to the desired height by using the erection Griphoist. Nine guy wires are used with the mast; three are connected to each of three guy anchors. Technical characteristics are given in table C-9.

1-18. ANTENNAS.

a. AS-1898/G (Log Periodic) Rotary Beam. The Antenna, AS-1898/G (shown mounted on a 50-foot telescopic and also on a shorter dielectric mast in figure 1-1, and shown in a detail view in figure 1-26), is a broad-band vhf and uhf log periodic communications antenna used to receive rf energy in the 30- to 1100-MHz frequency range. The AS-1898/G provides a directional radiation pattern with a horizontal beam width of 50 degrees and an average gain of 6 dB over a standard dipole. By means of the antenna pedestal (figure 1-23), the antenna can be rotated horizontally and can also be repositioned for horizontal, 45-degree, and vertical polarization. To allow fast, convenient assembly, the AS-1898/G has been designed for complete

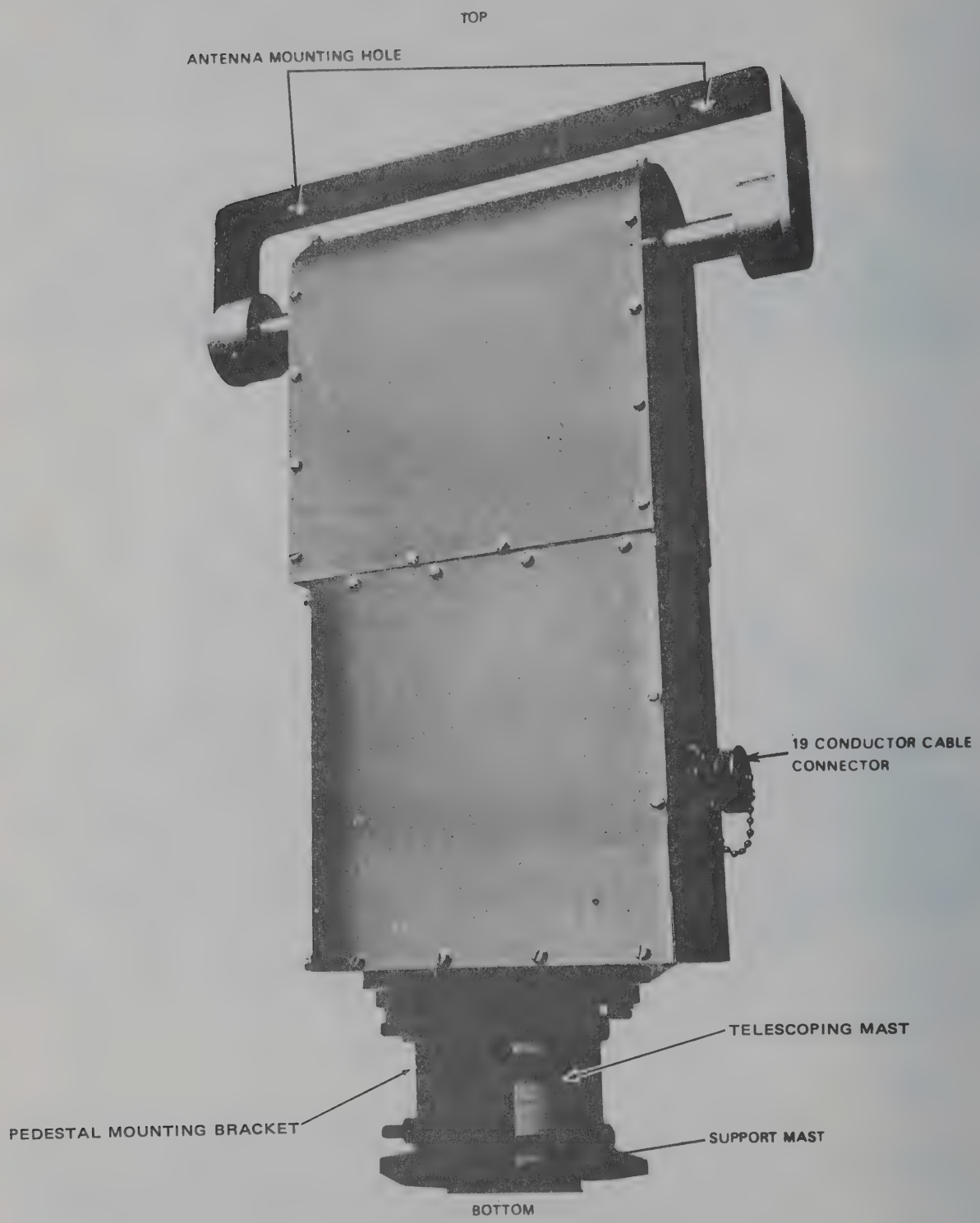


Figure 1-22. Antenna Pedestal, AB-991-G

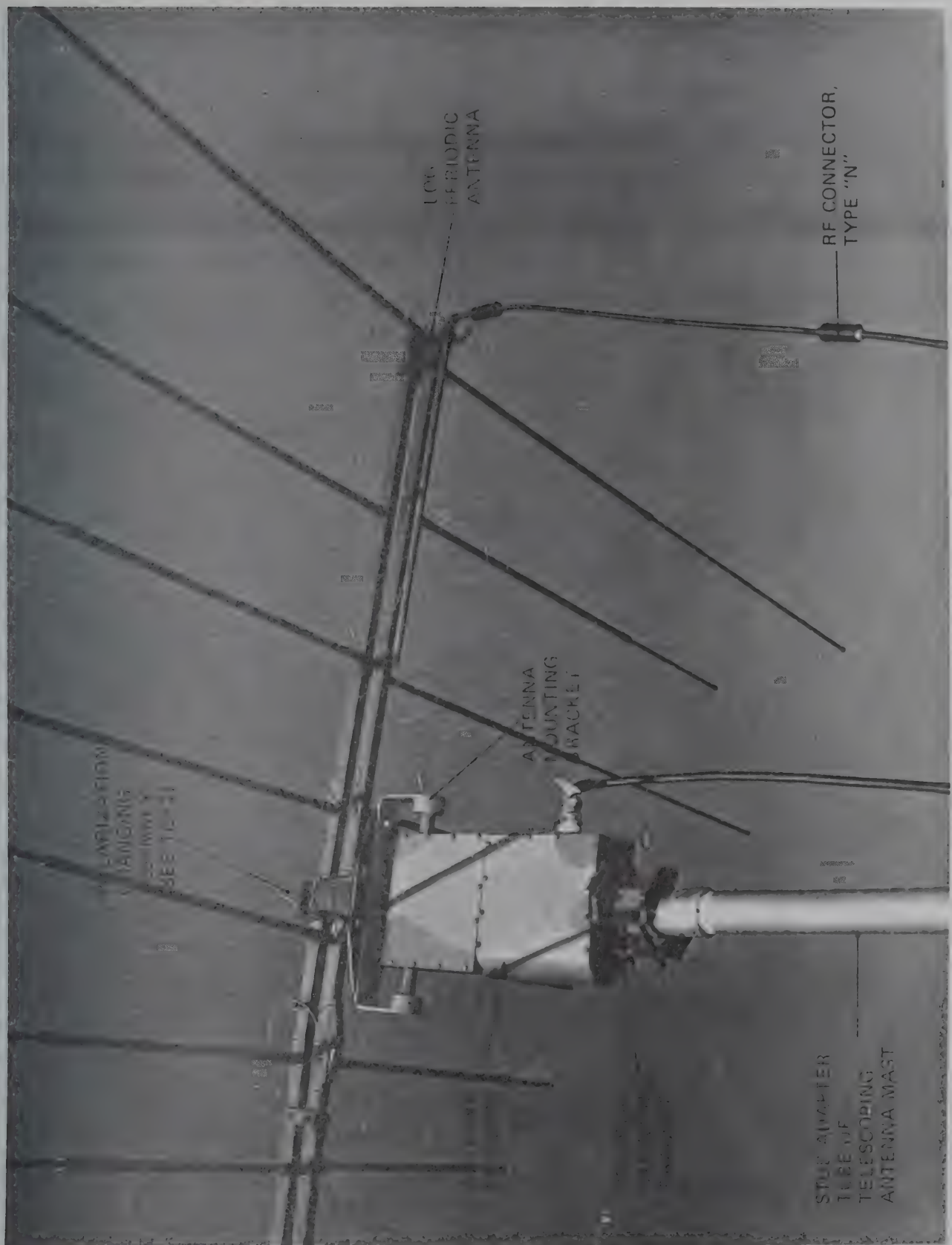


Figure 1-23. Antenna Pedestal, AB-991-G, Installed View

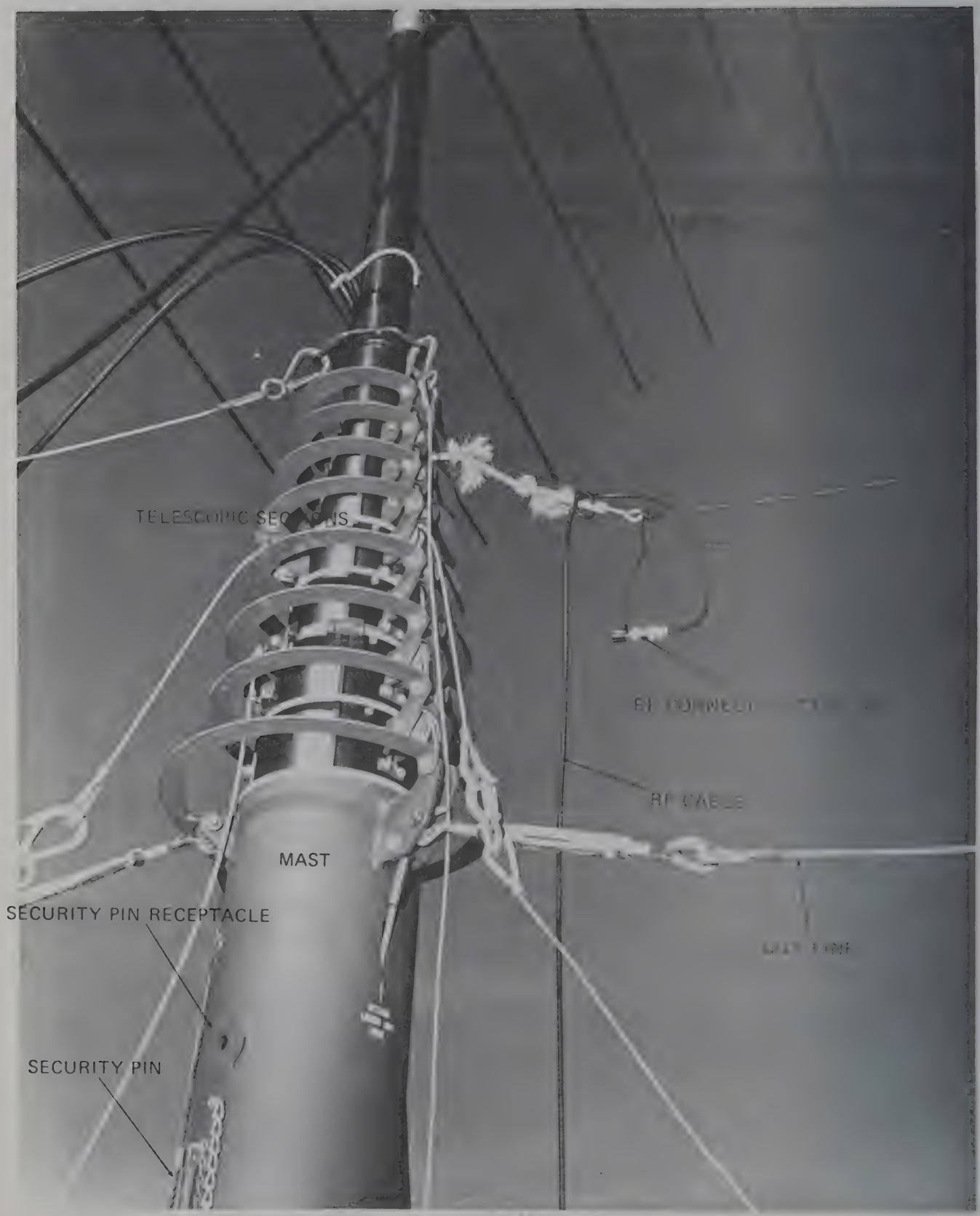


Figure 1-24. Antenna Mast, AB-746/G, Nested View

Figure 1-25. Antenna Mast Base, Installed View

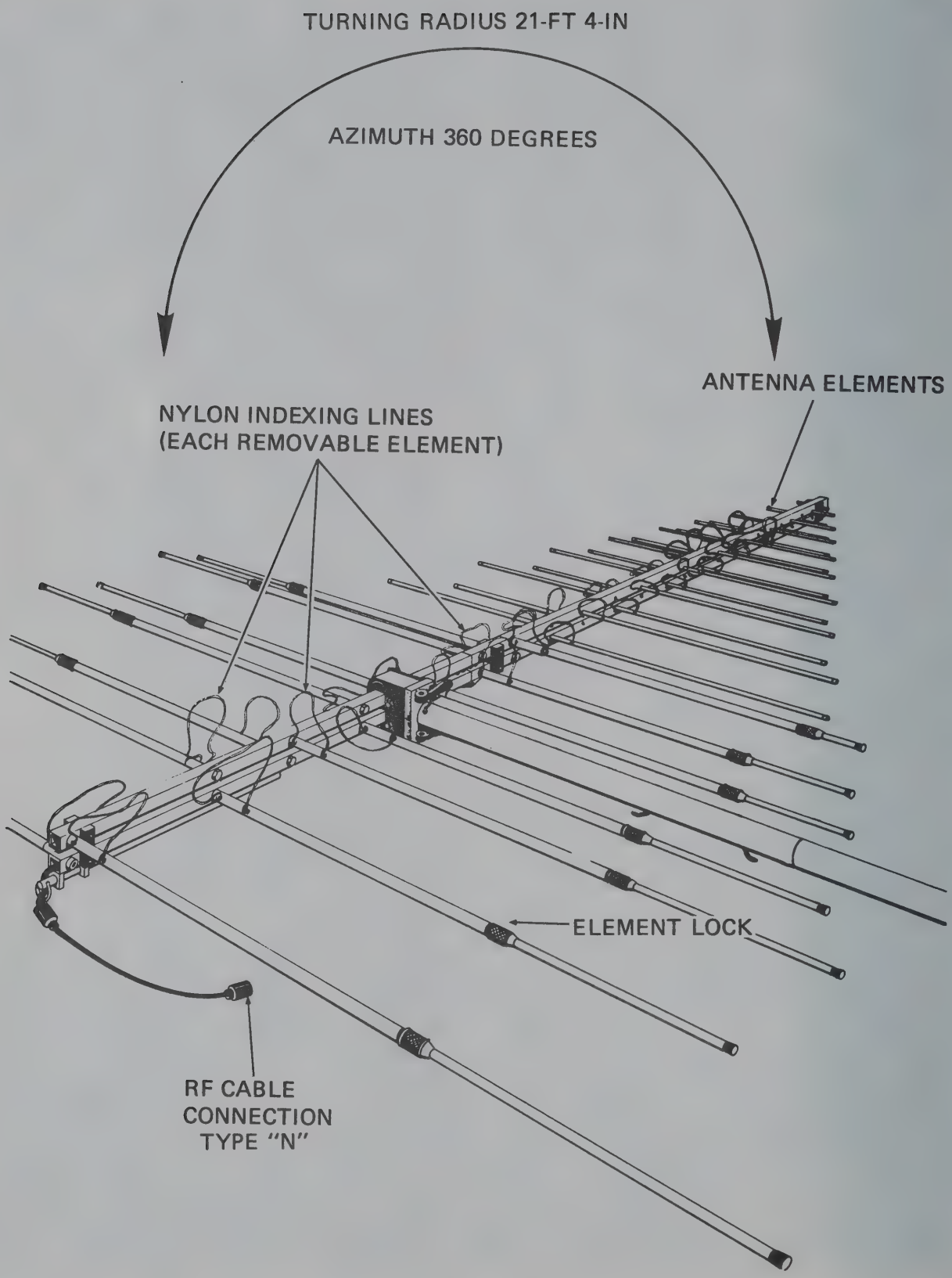


Figure 1-26. Antenna, Log Periodic, Rotary Beam, AS-1898/G

portability. It consists of a folding feeding system and a boom incorporated into the same structure. All elements shorter than 6.25 inches are permanently attached to the antenna boom with crown nuts and washers. Those elements 6.25 inches (and longer) attach to the boom by means of spring-loaded detents that prevent telescoping elements from slipping when in extended positions. A nylon indexing line (figure 1-26) is fastened between each removable, telescoping element and its fitting on the boom proper. This is to ensure that there will be no errors when attaching elements to the boom. A type "N" rf female connector is permanently attached to the coaxial feedline on the high frequency end of the antenna (figure 1-26). This connection will accommodate RG-8A/U Coaxial Cable chosen to give a power handling of 200 watts cw and 500 watts peak envelope power at installations requiring transmitting facilities in addition to receiving. Technical characteristics of this log periodic antenna are described in table C-10.

b. Whip Antenna. A standard omnidirectional Whip Antenna, MS-116A (the center antenna depicted in figure 1-1), is used with this radio intercept facility for receiving all hf frequencies. The whip antenna can be installed on a telescopic mast as shown in figure 1-1 for more permanent site installation. It may also be used with a fiberglass dielectric or similar mast installed in one of the antenna mounting bases on the upper corners of the operating van. The latter method, using the mast supplied with the AS-1898/G Antenna, is used for mobile or temporary operating configurations.

c. Long-Wire. For the more permanent installations where a whip antenna is no longer suitable with respect to antenna gain, a long-wire antenna may be installed between two telescopic masts. Such installations, whether for purposes of deception or terrain irregularities, are usually remoted a distance from the operating van.

CHAPTER 2

PREPARATION FOR USE, DISABLING, AND DESTRUCTION

SECTION I

INSPECTION AND HANDLING

2-1. GENERAL.

The radio intercept facility is issued as a complete unit less a power source, a transporting vehicle, and the accessories trailer. This chapter discusses the receipt of the radio intercept facility equipment, preparation for use, installation of equipment, and destruction to prevent enemy use.

2-2. INSPECTION UPON RECEIPT.

When prepared for shipment, all radio intercept facility equipments, except antennas, are operationally installed in the shelter and then secured by retaining bands. Upon receipt, conduct an overall equipment inventory by comparing items received against the accompanying packing list. Observe whether or not all retaining fasteners, dials, knobs, indicators, connecting wires, and hookup plugs and jacks appear in satisfactory condition. Check all controls for ease of operation and rotation. Tighten all loose knobs. Note meter enclosures, looking for cracked or broken glass and meters beyond their peg limits. Observe exteriorly-visible power and signal cables to ensure that none are frayed, kinked, broken, or wedged between equipment and rack mounts. Note the condition of the antenna transit case and the case formed by the three retracted legs of the telescoping antenna mast base (figure 2-1). Inspect antennas and accessories for shipping and handling damage. Close inspection of all equipment is necessary since damage by puncturing and dropping (though not obvious at first glance) frequently creates installation and later operating problems. Record and report all discrepancies in accordance with existing supply procedures.

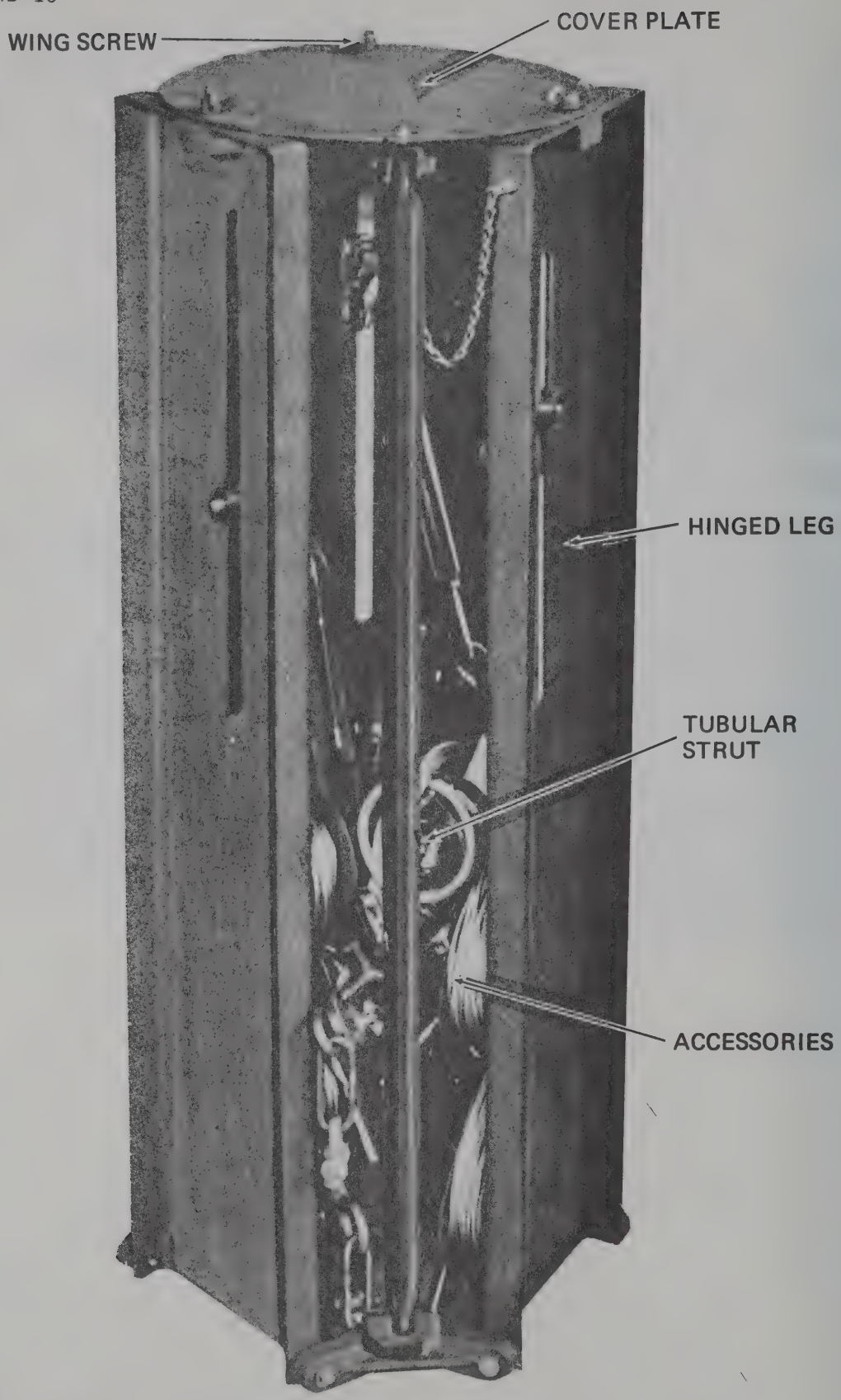


Figure 2-1. Antenna Base with Mast Guying and Lifting Components (Base Shown Closed)

SECTION II

ANTENNA INSTALLATION

2-3. ANTENNA SITE SELECTION.

The site selected for the 50-foot, log periodic antenna installation should be relatively level and free from obstacles that might mask the antennas. Overhead clearance is important since the minimum turning radius of the rotary antenna is 21 feet, 4 inches. The whip antenna should be located on level but rather high ground. The long wire antennas should be located on the highest ground, in the immediate vicinity of the operating shelter.

2-4. TOOLS AND MATERIALS REQUIRED FOR ANTENNA AND EQUIPMENT INSTALLATION.

The radio intercept facility comes completely assembled except for antennas, antenna masts, and connections to the antennas. Only shop tools and an anchor driving sledge are necessary. All other tools, instruments, and testing devices are provided in the standard radio mechanic's kit as authorized by organizational/ field maintenance tables of allowances and equipment.

2-5. ANTENNA INSTALLATION.

2-6. UNCRATING ANTENNA COMPONENTS. After the desired site of installation has been determined, move the metal antenna cases as close as possible to the installation site. First, unfasten the latches on the antenna transit case and carefully lift off its cover, placing it top-side down. The next step is to remove from its case the antenna rack to which the antenna boom and elements are attached. Figure 2-2 depicts the antenna rack removed from the transit case. Part of the antenna rack

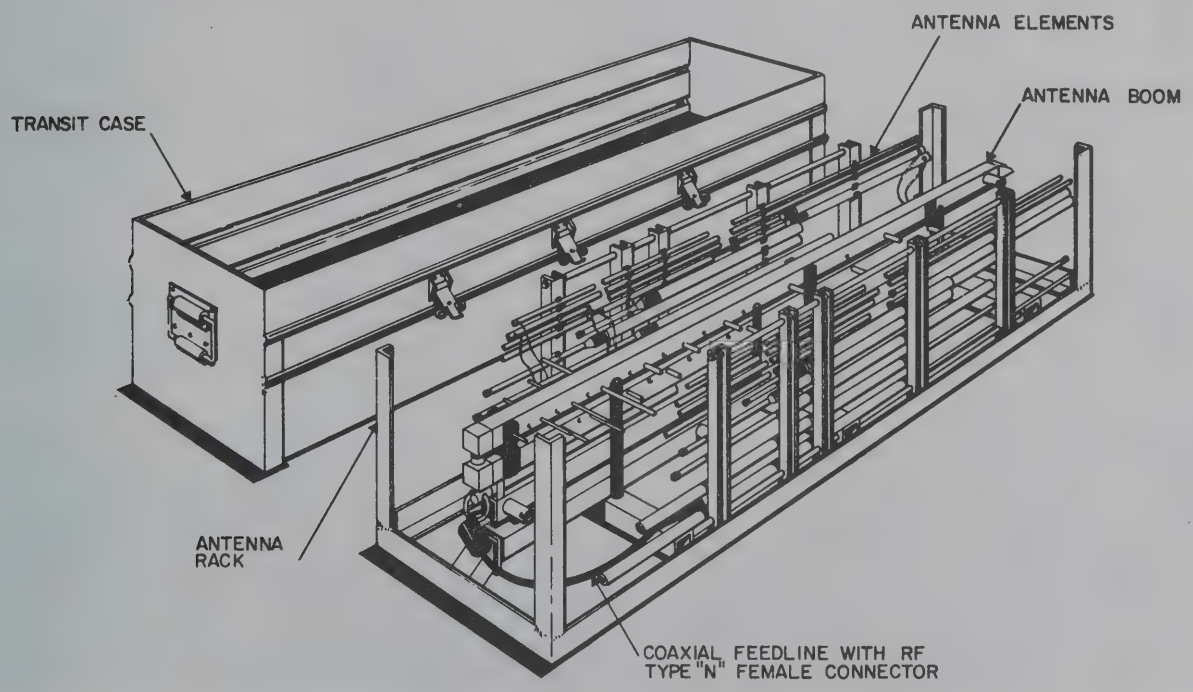


Figure 2-2. Antenna Rack Removed From Transit Case

siding is on hinges. Observe from figure 2-3 how both of the longer sides can be laid down flat to provide access to the antenna boom and elements. Note the position of the indexing lines and antenna elements. Even though the antenna components are

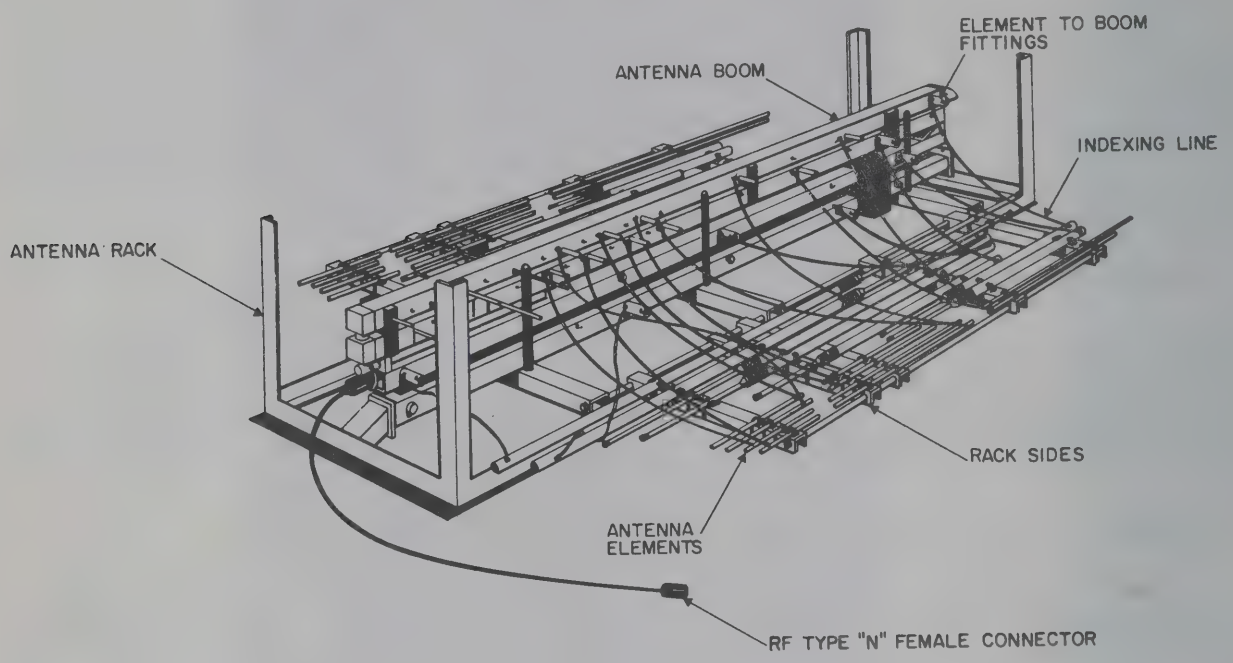


Figure 2-3. Antenna Rack with Sides Opened and Lying Flat

now accessible, it remains a relatively complex matter to unfold the antenna boom properly, attach it to the antenna pedestal, and move the assembly to the roof of the operating van as shown in figure 2-4. To avoid bending or breaking, the extremely long antenna elements (not preinstalled) must remain suspended temporarily by their nylon indexing lines during this process (figure 2-5). Figure 2-5 also demonstrates an acceptable method of orienting the antenna in a vertical plane to facilitate attaching the longer elements to the boom as shown in figure 2-6. After all antenna elements have been attached mechanically and adjusted to approximate length for frequency (described in paragraphs 2-3 and 3-3 of TM-04659A-10), the antenna coaxial feed cable should be attached prior to elevating the antenna into the operating position (figure 2-7). Close-up views of an antenna mast in its antenna bracket on the rear corner of the radio intercept facility shelter are illustrated in figure 2-8.

2-7. ASSEMBLING THE AS-1898/G ANTENNA ON GROUND LEVEL. After the desired location for the second log periodic antenna has been determined, move the antenna as close as possible within the immediate working area. Unfasten latches on the transit case and carefully lift off the cover. Remove the rack to which the antenna is attached and fold down both sides so that the rack lies flat. Attach the elements to the top boom, working from the shortest to the longest element. Turn low frequency elements approximately one quarter turn counterclockwise, or until free, then extend and turn clockwise until locked. After the elements have been attached to the top boom section, unfold the antenna boom and lock both sections together by use of the spring-loaded pin provided for this purpose. Attach the elements to the rear end of the extended antenna. Pull out the feedline support. The antenna is now ready to be lifted from the rack and placed on the mast assembly.

Figure 2-4. Lifting Antenna to Roof of Operating Van

Figure 2-5. Positioning Antenna Boom in a Vertical Plane Prior to Final Assembly

Figure 2-6. Installing the Longer Antenna Elements

Figure 2-7. Raising Assembled Antenna

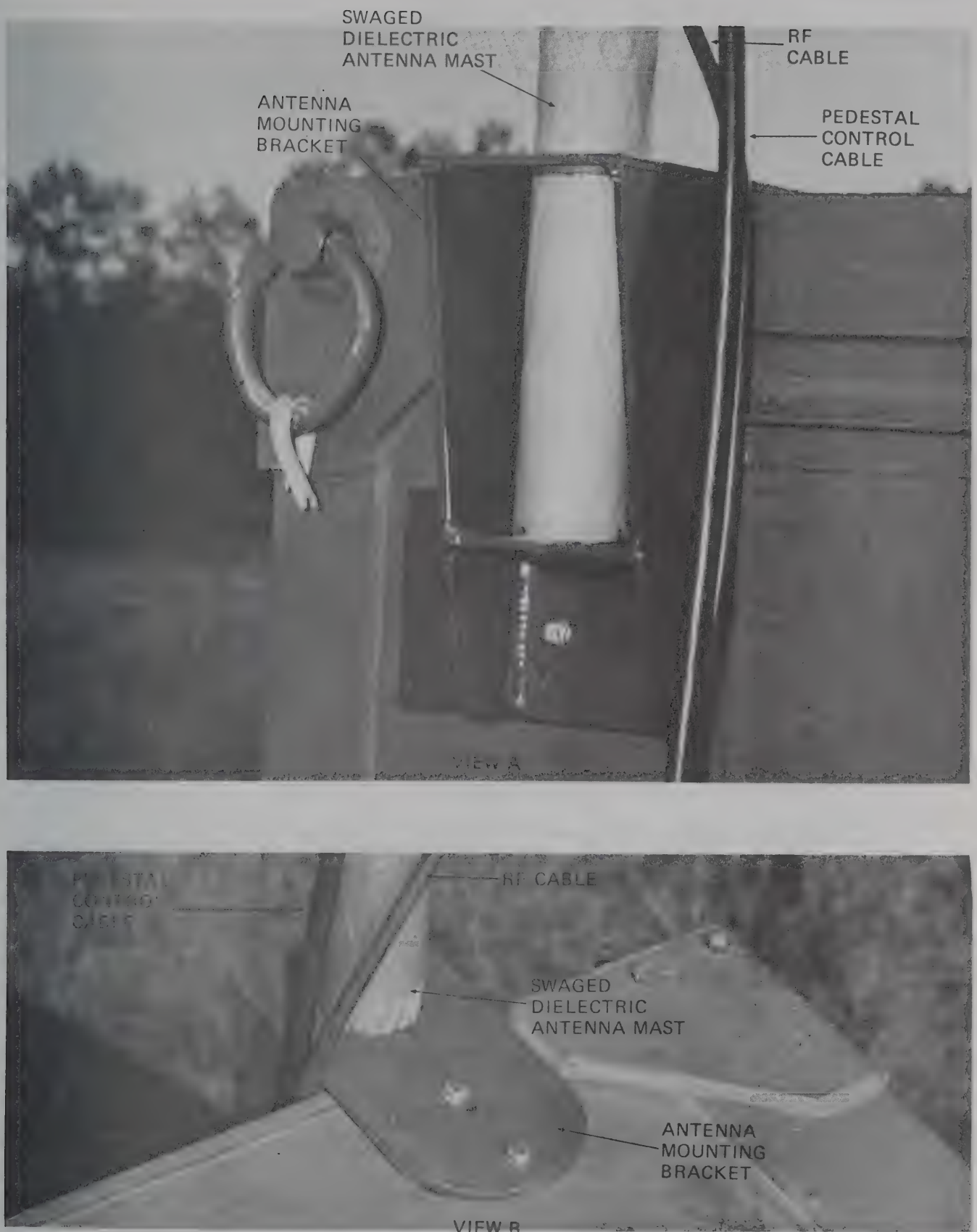


Figure 2-8. Antenna Mast Installed in Antenna Bracket

2-8. RAISING TELESCOPING ANTENNA MAST.

a. When making final plans to erect the 50-foot telescoping mast (AB-746/G), ensure that a complete mast assembly is on hand. A complete assembly consists of one crated transit case (shown in figure 2-2) and the case formed by the three retracted legs of the antenna base (banded in a corrugated paper box). The latter container (see figure 2-1) is formed by raising the three mast-supporting legs at their hinges and securing them in an upright attitude by fastening a steel plate to the legs with three wing screws.

NOTE

A circular, case-supporting cover plate is attached to one leg by means of a toggle chain. Do not sever this chain or remove cover since the mast base assembly cannot be repackaged for transit or storage without this plate.

b. To prepare the antenna base assembly and erect the mast:

1. Loosen the three wing screws at the top of the antenna base assembly storage container (antenna base assembly previously illustrated in figure 2-1).

2. Clear an area with a radius of 30 feet before spreading the hinged legs.

3. Remove the screws holding the three tubular struts to the cover plate; remove the struts and replace the screws in the cover plate.

4. Remove accessories stored in the base assembly.

5. Check each item now visible with the following list:

1 mast base assembly.

1 hoist mechanism (Griphoist type).

1 clutch handle with spare shear pins inside handle.

1 drive rod assembly.

3 green guys on reels (lower - 56 feet long).

3 blue guys on reels (middle - 55 feet long).

3 red guys on reels (upper - 77 feet long).

1 guy anchor locating cable (30 feet by 1/8 inch).

3 arrowhead type anchor devices with 4-foot cable and anchor ring.

9 snubbing devices (Snubit type) each complete with lock screws and clevis assembly.

3 tubular struts, each complete with two captive lock pins.

1 upper guy adapter.

6. Position the base assembly, with guy cable stowage reels facing up, so that the center casting of base assembly and all three legs seat firmly on solid ground (see figure 1-25 for an installed view).

NOTE

Though base assembly legs are adjustable, are supported by movable, strut-supporting slide plates, and can be made stable on irregular terrain configurations, it is still better to place casting and legs on reasonably level ground so as to plumb the antenna mast more readily.

7. Uncrate the antenna mast assembly, being careful not to damage the tube or rings. Lay it horizontally in the vicinity of the mast base assembly where it will not interfere with installation progress.

8. Uncoil one group of any color-coded guy cables. Extend all three cable ends outward from the mast base to their full lengths keeping each parallel to one of the base legs. Repeat this step for the remaining two groups of three guy cables. Ensure that the wire rope is reeled and unreeled in a straight line to prevent loops and kinks.

9. Reposition the mast so that the bottom tube lip of the base is near the outer ridge of the base plate hub. Ensure that both are properly oriented with respect to their final position.

10. Attach the upper guy adapter to the stub tube.

11. Attach antenna pedestal (antenna repositioning device) to the stub tube as follows:

(a) Slip the case bracket (view A, figure 2-9) over the top edge of stub adapter tube. Make the four 3/8-inch nuts on the 3/8-16 x 4-inch bolts only finger tight to allow repositioning and shifting of the bracket.

(b) Attach the adapter plate (view B, figure 2-9) to the bottom of the antenna pedestal by inserting and tightening the single 5/8-18 x 1-1/4-inch bolt until it bottoms.

(c) Bolt the antenna pedestal with the adapter plate in place to the cast bracket using the four 5/16-18 x 7/8-inch bolts provided.

NOTE

Make certain that both a 5/16 inch flat washer and a lock washer are placed on the shank of the bolts before inserting and tightening them to 14 foot-pounds.

(d) Tighten the four bolts holding the cast bracket to the stub adapter tube. (Refer to subparagraph (a) above.)

12. Ensure that all control and power cables are attached to the antenna pedestal.

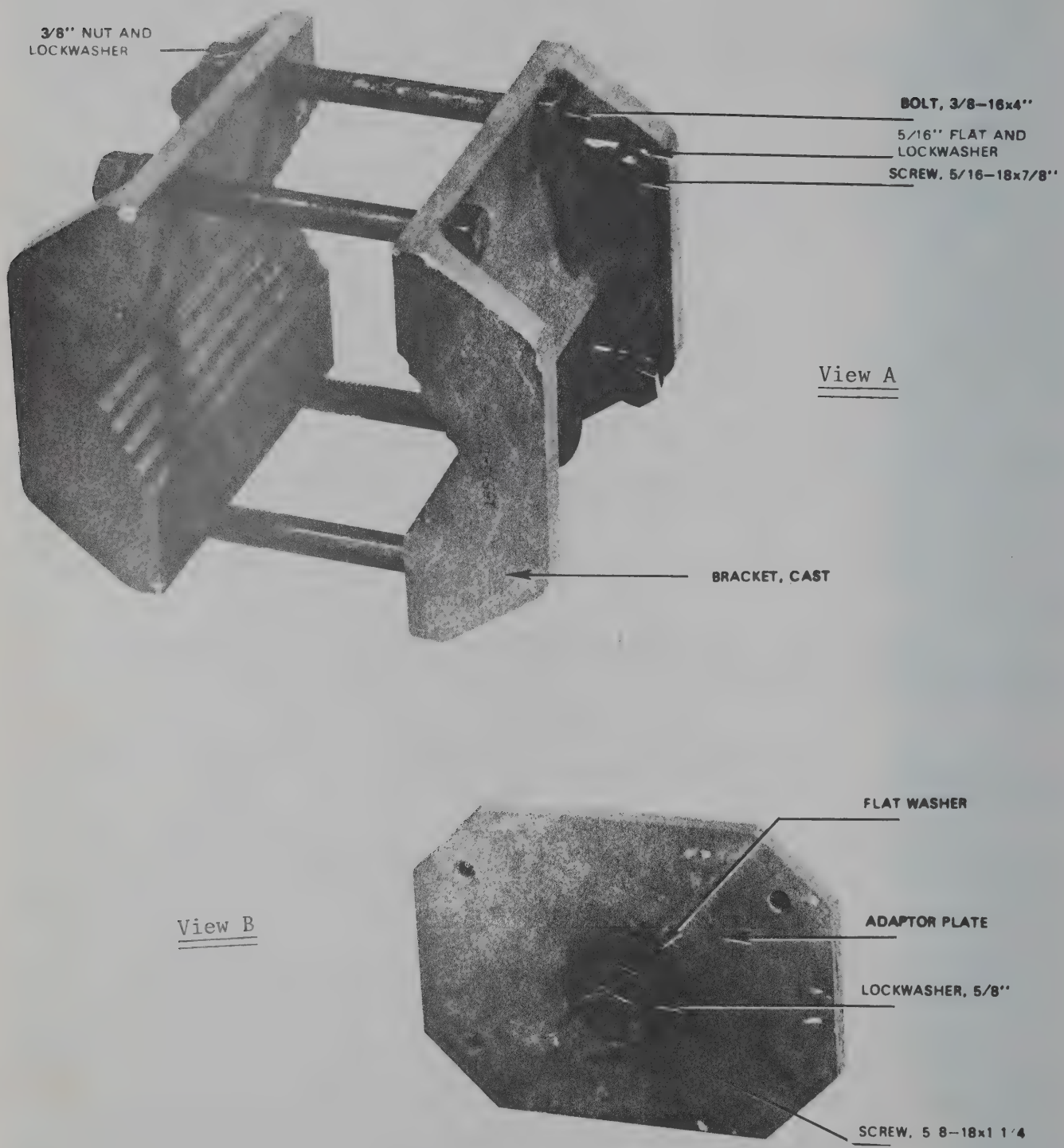


Figure 2-9. Pedestal Mounting Bracket and Adapter Plate

13. Attach antenna array to antenna pedestal. No bolts are required. The antenna will mount to the pedestal by use of two quicklocks. See figure 1-26. This involves matching up the holes on the bottom of the antenna to the holes on the pedestal. A spring-loaded quicklock will then be inserted in each of the holes and turned 90 degrees. This will hold the antenna in place. Connect the coaxial signal cable; then insert the stub tube into the top of the mast.

14. Insert the three upper guy hooks into the upper guy adapter. The hooks and tie points are color-coded red. Insert the three middle guy hooks into the thimbles in the cables extending from the fourth mast section. These connection points are color-coded blue.

15. Raise the mast to a vertical position (figure 2-10). Ensure that the base tube fits over the ridge on the base plate hub. Rotate the mast until the key on the base tube locks into the mating slot in the base casting hub.

16. Locate the three points marked "ATTACH STRUTS HERE" on the base tube. While supporting the mast, attach the ends of the tubular struts to the mast bracket using the lock pin which is attached to each strut by a chain.

17. Loosen the wing screws locking the slide plates in the base legs, position the slide plates, and attach the ends of the three struts to the slide plate brackets using the lock pins which are attached to the struts by chains.

18. Before tightening wing screws to lock slide plates in position, be sure that the base legs are firmly seated on the ground and that the mast is plumb. Tighten the wing screws to lock the slide plates. The mast will now be supported by the base and struts.

19. Hold one end of the 30-foot, guy line anchor-locator cable firmly against the base tube and aline the cable with the center of one base leg. Extend this cable until it is taut, maintaining a straight line by allowing the cable to touch one side of the strut lightly. The first guy line anchor is to be sunk at the outer extreme point of the extended locator cable.

20. Attach one guy anchor arrowhead to the drive rod, and drive the arrowhead into the ground at a 45-degree angle (figure 2-11) away from the mast until the ring attached to the anchor cable is at ground level.

21. Connect the cable ends of the three guy cables adjacent to the anchor ring with their matching color-coded snubbing devices (Snubits).

22. Attach the Snubit-connected lower guy (color-coded green) to the anchor ring using the clevis on the Snubit (figure 2-11). Connect the other end of the same cable (with the turnbuckle) to the point provided at the upper end of the base tube.

23. Repeat the four preceding steps to locate the two remaining anchors and connect the other two lower guy lines.

24. Pull up on the loose end of the lower guys to take up slack, then lock the Snubits by turning down the wing screws.

25. Adjust the turnbuckles equally to tighten the lower guy lines. Check to see that the mast is still plumb after the lower guys are tightened and make any necessary corrections before proceeding further with the mast erection.

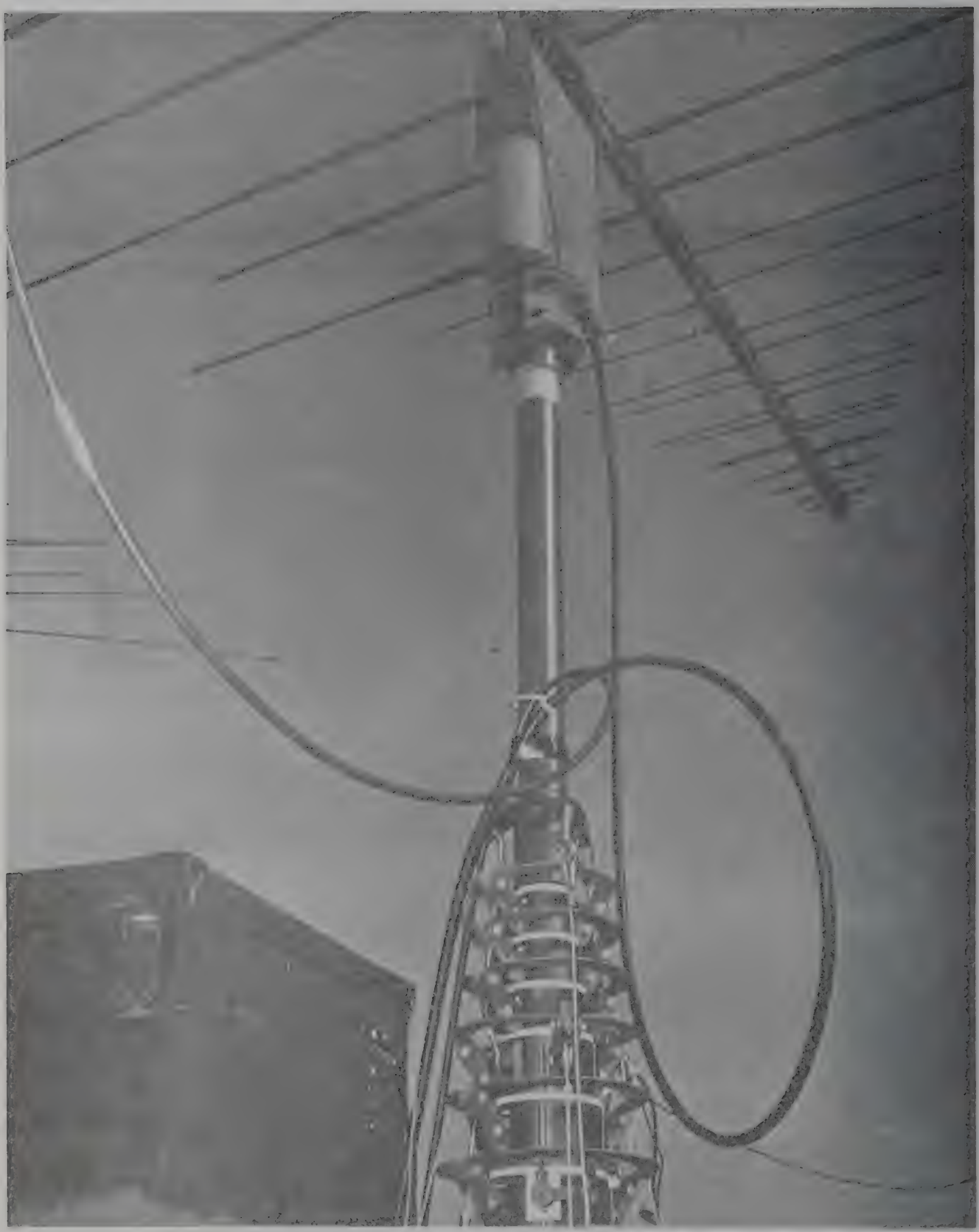


Figure 2-10. Entire Antenna Assembly and Mast in Vertical Position Prior to Guying

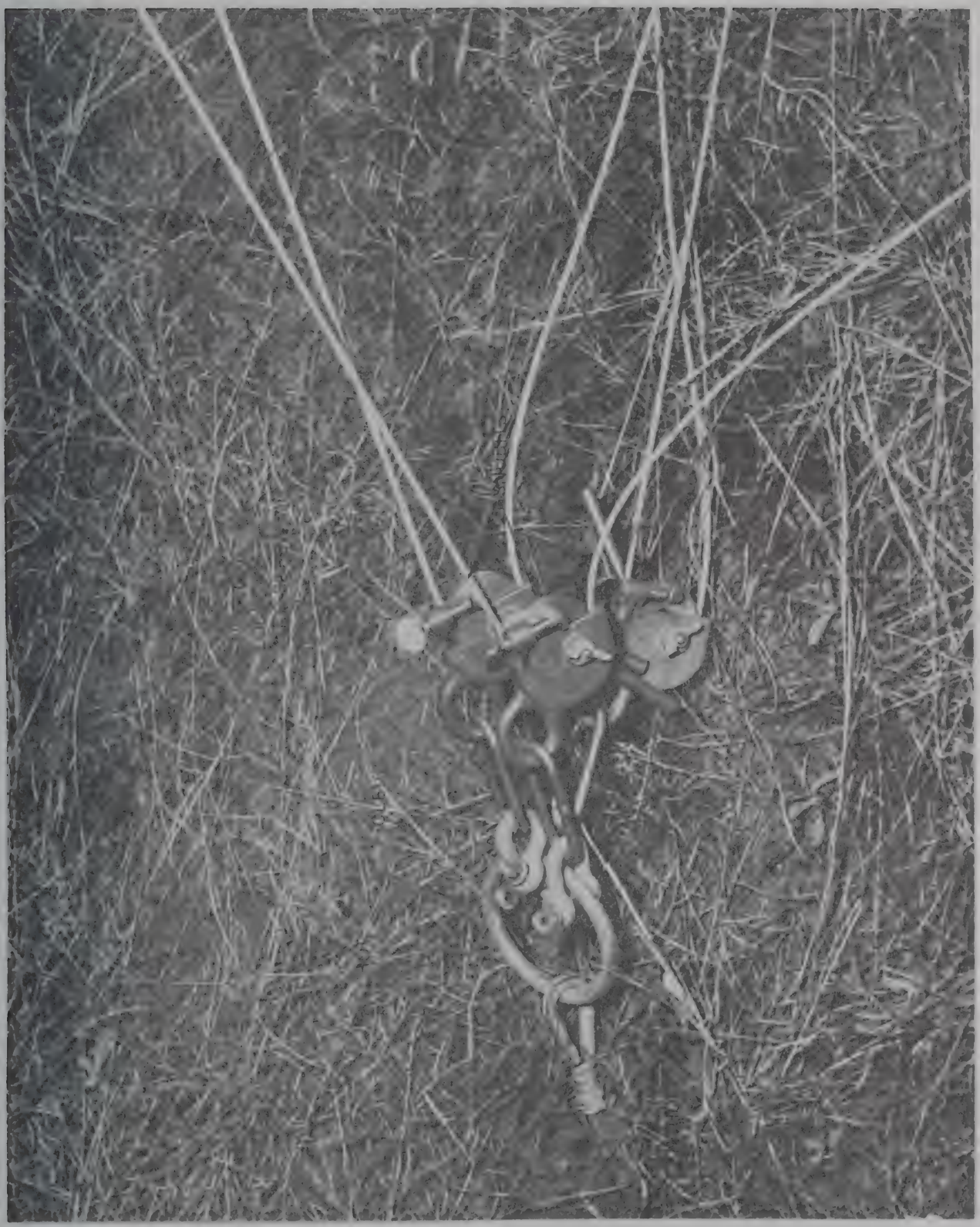


Figure 2-11. Anchor Sunk at 45° Angle; Snubits Attached

CAUTION

Be sure that all mounting pins are fully and properly fixed in the mounting slots and that the safety locking pin is in place before elevating the mast.

26. Place the tower lifting mechanism (figure 2-12), which was stored in the base, on the mast mounting pad so that the keyhole-shaped slots in the Griphoist mounting plate seat properly on the locking pins of the mast. Insert the safety locking pin which is attached above the top mounting pin of the Griphoist.

27. (Refer to the numbered parts in figure 2-12.) Before introducing the main lifting cable wire rope into the tower lifting mechanism (Griphoist), move the reversing (lowering) action lever (8) into a horizontal position. Press on the clutch lock pusher (6). Lift and hold activating lever (7), then release the clutch lock pusher (6) until clutch activating lever is locked. This opens the two cable jaw blocks. Manually work the tapered end of the main lifting cable (wire rope) into the rope entry bushing (1), and push cable down through the Griphoist until it emerges and protrudes from the lower end. Pull the wire rope through the machine by hand until disposing of the excess slack. Place clutch activating lever (7) back into operating position (down). This is done by slightly lifting the lever (7) and pressing the clutch lock pusher (6). This allows the spring inside the machine to carry the lever into its initial position.

28. Attach the handle (2) to the power stroke lever (5) (figure 2-12). Operate the Griphoist using full up and down handle motion until the topmost marking "ATTACH MIDGUYS" appears on the first mast section (figure 2-13).

29. Attach the Snubits of the three middle guys (color-coded blue) to their respective anchor rings (see previously illustrated figure 2-11).

30. Draw each middle guy cable through its Snubit until there is tension on the cable and lock the Snubits by turning the wing screws against the pins. The tension of the three middle guys should be reasonably equal.

31. Operate the Griphoist until the bottom line appears on the first mast section "STOP." The mast will now be extended to its full (50-foot) height.

32. Slowly operate the Griphoist until the latch on the second mast section engages. When this occurs, a red marker (flag) will appear at the top of the second section.

CAUTION

Exercise care not to inadvertently release the clutch lever on the bottom of the Griphoist. To do so will cause the antenna mast to collapse if the security pin is not installed.

33. Insert the security pin in the base section (figure 2-14).

34. Move the Griphoist handle to the lowering lever and operate the Griphoist until the mast weight is bearing on the lock pin.

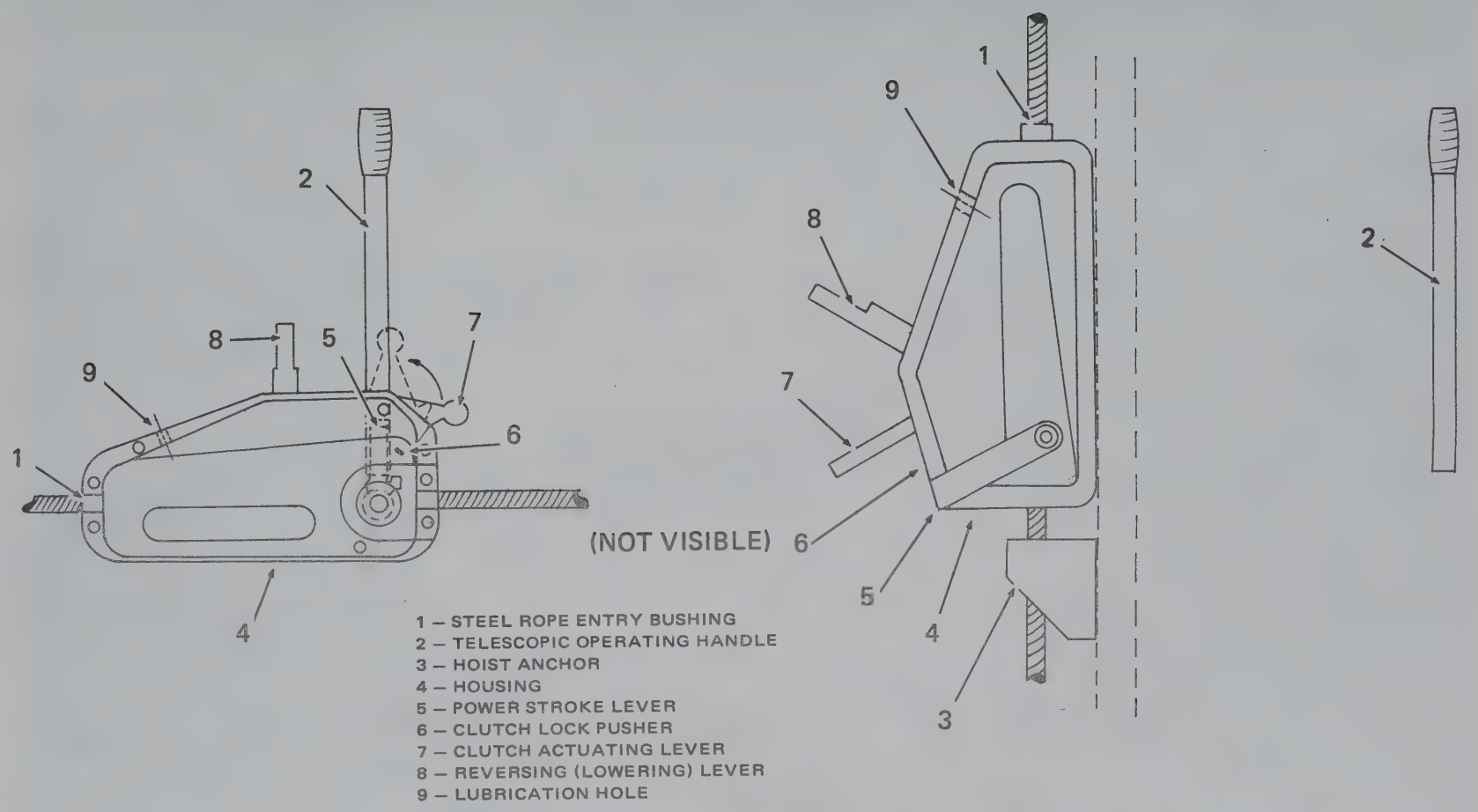


Figure 2-12. Tower Lifting Mechanism

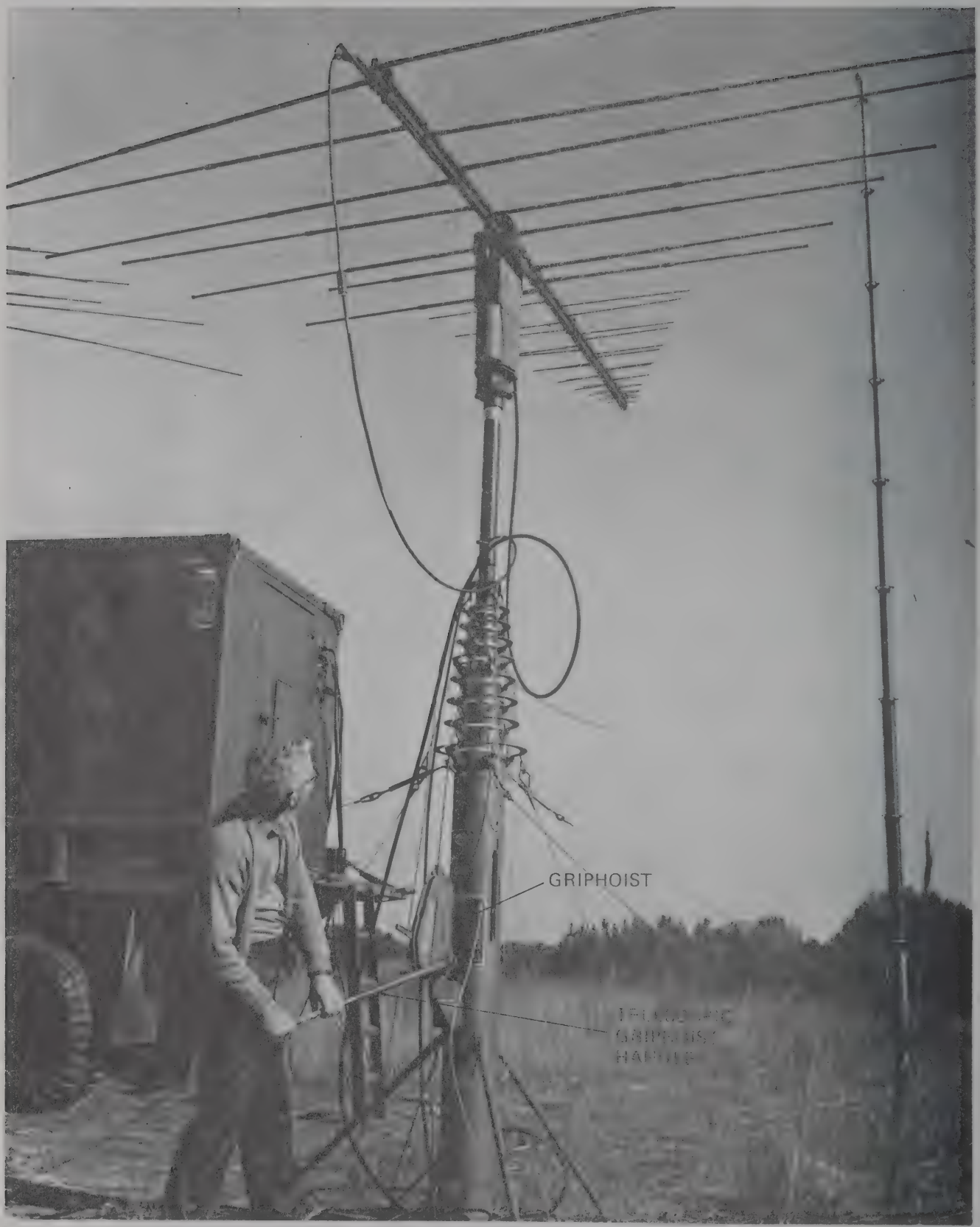


Figure 2-13. Elevating Antenna on Telescoping Mast Assembly

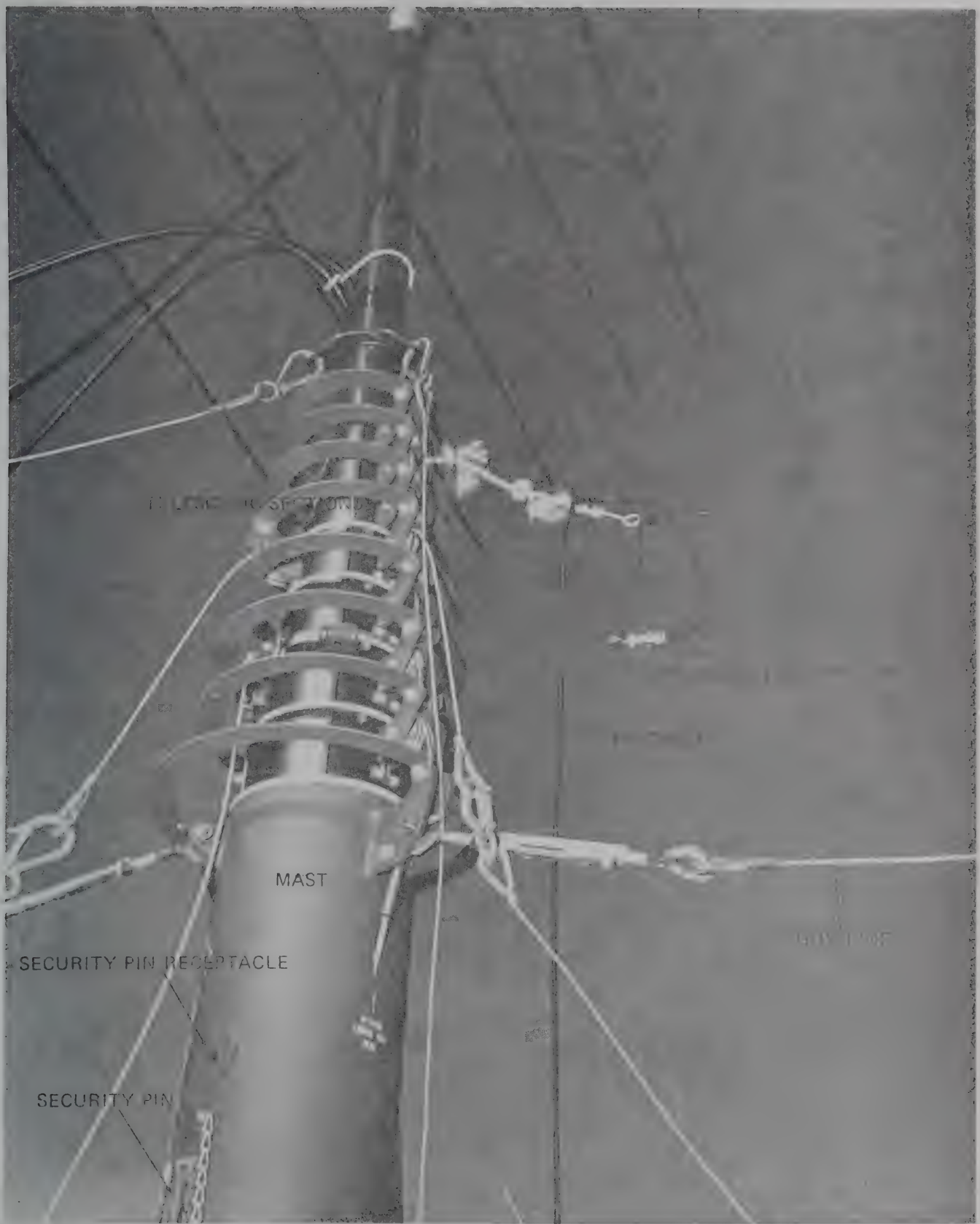


Figure 2-14. Guy-supported Antenna Assembly Ready for Elevation

CAUTION

To avoid antenna mast collapse, take care that the mast remains straight and plumb when tightening the upper guys.

35. Attach the three upper guy Snubits to their respective anchor rings and draw up the upper guy cables (color-coded red) until there is equal tension on all three. Lock the upper guy Snubits at 35-pounds maximum pull on each guy.

36. Remove the Griphoist handle. Store it for future use with the drive rod, the locator cable, and empty cable reels.

2-9. ELECTRICAL ANTENNA CONTROL AND SIGNAL CABLE CONNECTIONS. All connections for controlling the position of log periodic antennas are made by means of 19-pair cable connected between plugs on the antenna pedestal (see figures 1-22 and 1-23) and the jacks labeled ANTENNA CONTROL on the cable terminal (see figure 1-6). Antenna rf signal cables are similarly attached to two or more of the four available antenna connections labeled for whip, long wire, and log periodics. Connections within the operating shelter are all prewired. Refer to paragraph 3-57 of this manual for hints on orienting the AB-991 Antenna Pedestal so that its azimuth and polarization coincide with the readings on the dials of the C-7120/G Antenna Control Unit located in the common equipment rack inside the shelter.

NOTE

It may be necessary to rotate the antenna pedestal prior to installing the antenna so as to aline the white arrow on the antenna control unit dial with the top of the scales on the dials.

SECTION III

SYSTEM CABLING AND POWER

2-10. VERIFICATION OF EQUIPMENT HOOKUP.

The entire radio intercept facility is prewired and there should be no need for making electrical connections inside the shelter. However, since some connectors may have been shaken loose in transit, check each cable between equipment and racks to ensure positive contact.

CAUTION

Some interconnecting cables have been shortened to prevent stray coupling. Exercise due care in sliding equipment out of racks for checking cable connections, particularly the tape recorder/reproducer. Only 10 inches of cable slack is available to this unit.

2-11. PRIMARY POWER SOURCE AND DISTRIBUTION.

The intercept facility requires both ac and dc current to operate. The maximum power requirement is 22 kW at 120-vac, single-phase; at 208-vac, three-phase; and at 28-vdc. Normally a trailer-mounted generator (PU-708) is used with the radio intercept facility. In emergencies, the lesser-powered generator, PU-607, will operate the radio intercept facility less the air conditioner. Refer to paragraph 1-5g for additional information regarding power provision. The power distribution panel, located above and to the right of the supervisor, is shown at figure 2-15. Figure 2-16 shows the POWER INPUT and POWER OUTPUT connectors of the cable terminal located at the right of the shelter door.

NOTE

It is mandatory that the 28-vdc power source never be turned off while the shelter is in an operational status. To do so would prevent the antenna coupler and antenna preselectors from operating, thus making it impossible to receive radio signals.

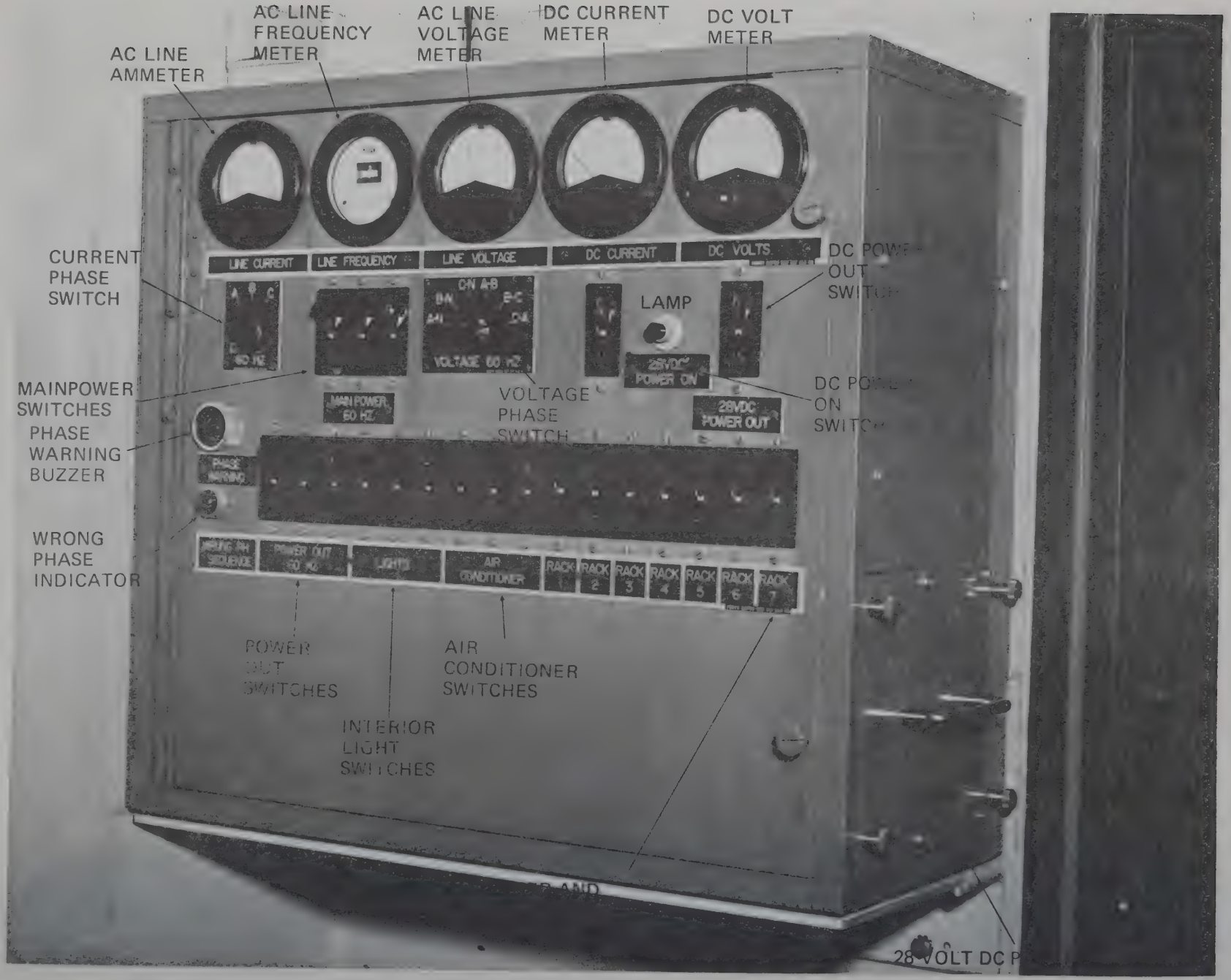


Figure 2-15. Power Distribution Panel

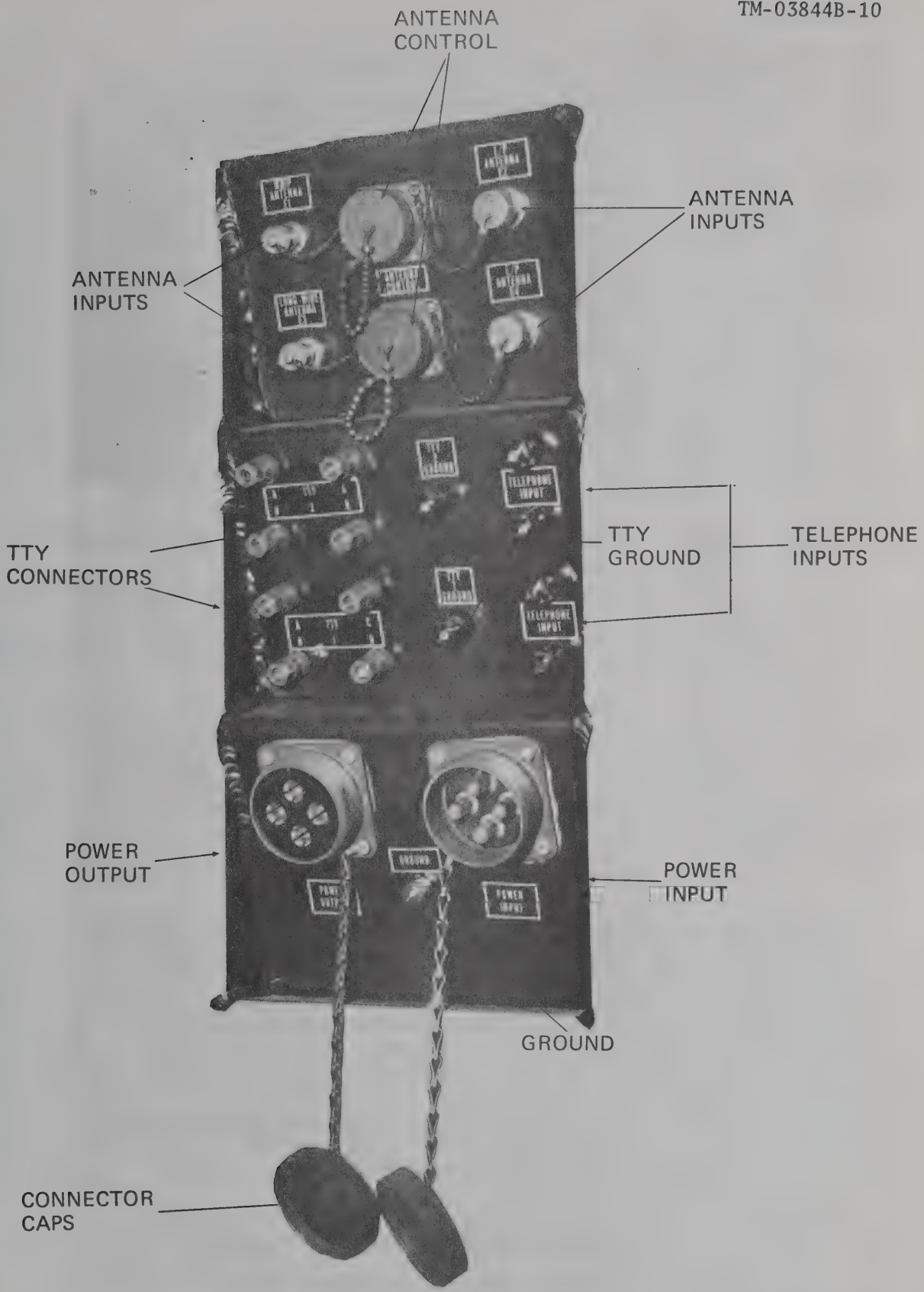


Figure 2-16. Power Input and Power Output Connectors of the Cable Terminal, AN/TSQ-54A

SECTION IV

DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

2-12. GENERAL.

a. Destruction of the radio intercept facility shelter, vehicle, and trailer (when subject to capture or abandonment in a combat zone), will be undertaken by the using organization only when such action is necessary in accordance with orders of, or policy established by, superior commanders.

b. The information which follows is for guidance only. Certain procedures outlined below require the use of explosives and incendiary grenades which may not be authorized issue items for the unit concerned. The issuance of destructive materiel and the conditions under which destruction will be effected are command decisions based upon the tactical situation. The methods of destruction detailed in subsequent paragraphs should damage the equipment so much that repair is impossible. Acceptable methods of destruction are:

1. Physical. Requires axe, sledges, or similar implements.

2. Burning. Requires gasoline, oil, incendiary grenades, or other flammables.

3. Demolition. Requires suitable explosives or explosive ammunition. Refer to U.S. Army Field Manual (FM) 5-25, dated February 1971, (PCN 320 005120 00).

4. Gunfire. Includes artillery, tank guns, machine guns, rifles using rifle grenades, and launchers using antitank rockets and missles. Under some circumstances hand grenades may be used.

c. In general, destruction of essential parts, followed by burning, will usually be sufficient to render the radio intercept facility useless. However, selection of the particular method of destruction requires imagination and resourcefulness in the utilization of the means at hand. Time is usually critical.

d. Adequate destruction requires that all parts essential to the operation and control of the receivers, recorders, and antennas, including essential spare parts, be destroyed or damaged beyond repair. Top priority of destruction is to be granted to all tapes and documents referring to intercept procedures and signal analysis. When lack of time and personnel prevents destruction of all components, priority is given to the destruction of those parts most difficult to replace. Equally important, the same essential parts must be destroyed on all like equipment so the enemy cannot construct one complete unit from several damaged ones. After destroying tapes and documents, destroy: receivers, remote controls and operator panels, recorders, power supplies, power convertors, power generators, antennas, antenna cables, switching and control devices, and interunit cabling. Finally, destroy the vehicle itself, the trailer, and the tires.

e. If destruction is directed, due consideration should be given to:

1. Selecting a point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments or richocheting projectiles.

2. Observing appropriate safety precautions to prevent injury to operating crew.

2-13. DESTRUCTION BY DAMAGING AND BURNING.

a. Using an axe, pick mattock, sledge, or other heavy implements, smash all vital elements such as receivers, recorders, power sources, antennas, lights, instruments, and controls.

b. Destroy vehicle components such as radiator, fuel pump, carburetor, generator, and ignition system. If time permits, and a sufficiently heavy implement is available, smash the engine cylinder block and head, crankcase, and transmission. Puncture fuel tank as near the bottom as possible, collecting gasoline for use during later stages of demolition.

c. Slash tires. If tires are inflated, exercise care to prevent injury should the tire blow out while being slashed. Whenever practicable, deflate tires before slashing.

d. Pour gasoline and oil into and over the entire shelter and vehicle. Ignite by means of an incendiary grenade (fired from a safe distance), a burst from a flame thrower, a combustible train of suitable length, or other appropriate means. Take cover immediately. If gasoline and oil were not saved from the vehicle, or if the shelter is not vehicle mounted, use other flammables such as cleaning rags, oily waste, wood, or paper. Ignite by means of incendiary grenades or other suitable means.

WARNING

Immediate cover must be taken since fire may cause quick detonation of stored explosives or ammunition. Due consideration should be given to the highly flammable nature of gasoline and its vapor. Careless handling of gasoline may result in painful burns.

2-14. DESTRUCTION BY DEMOLITIONS.

a. Explosive ammunition, if available nearby, should be removed from packing of other protective material. Place ammunition in and about the shelter and vehicle so that it will be fully exposed to the fire, yet be in such location that the greatest damage will result from its detonation. Remove any safety devices from ammunition. To destroy the vehicle, prepare two 2-pound charges of explosive, tnt (two 1-pound blocks, or equivalent, per charge, together with the necessary detonating cord to make up each charge). Set the charges as follows:

1. The first--on top of the clutch or transmission housing.

2. The second--as low on the left side of the engine as possible.

3. Connect the two charges with detonating cord for simultaneous detonation. Provide for dual priming to minimize the possibility of a misfire.

WARNING

Keep the blasting caps, detonating cord, and safety fuses separated from the charges until required for use.

4. For priming, either a nonelectric blasting cap crimped to at least 5 feet of safety fuse, or an electric blasting cap and firing wire may be used. Safety fuse, which contains black powder, and nonelectric blasting caps must be protected from moisture at all times. The safety fuse, which should be tested first, normally burns at a rate of 1 foot per 40 seconds. It may be ignited by a fuse lighter, cigarette lighter, or a match; the electric blasting cap requires a blasting machine or equivalent source of electricity.

NOTE

For the successful destruction of equipment involving the use of demolition materials, all personnel concerned must be thoroughly familiar with the pertinent provisions of FM 5-25. Training and careful planning are essential.

b. Destroy tires as stated in paragraph 2-13c.

c. Detonate the charges. If primed with nonelectric blasting cap and safety fuse, ignite and take cover. If primed with electric blasting cap, take cover before firing the charges. The danger zone is approximately 200 meters.

2-15. DEMOLITION BY GUNFIRE.

a. Destroy the tires as outlined in paragraph 2-13c.

b. Destroy the intercept facility by gunfire, using artillery, tank guns, machine guns, rifles equipped with rifle grenades, or launchers, using antitank rockets or missiles. Fire on the shelter and vehicle aiming at the engine, axles, wheels, or door of the shelter. Although one well-placed, direct hit may destroy the entire facility, several hits are usually required for complete destruction unless an intense fire is started. In that case, both vehicle and electronic equipment may be considered destroyed.

WARNING

Take protective cover when firing artillery at ranges of 500 meters or less, and when firing rifle grenades or antitank rockets.

CHAPTER 3

OPERATING INSTRUCTIONS

SECTION I

THEORY OF OPERATION

3-1. SCOPE.

This chapter contains information on the theory of operations, controls and instruments, and operations under specific conditions for the radio intercept facility. The theory of operation includes a discussion of signal recognition, transmission characteristics, and keying methods. Theories of operation vary with the different type systems that the operator will come in contact with while operating the radio intercept facility. This section will explain a few of the more common systems and workings to enable the operator to more fully understand and use the radio intercept facility. For a detailed description of tuning for each of these systems, read chapter 3, section II, of this manual.

3-2. SIGNAL RECOGNITION.

The radio intercept facility operator will encounter a variety of radio signals which he must recognize. He must be able to distinguish between the various forms of radio signal transmission methods so that he can record voice and telegraphic code signals of various kinds and distinguish between usable and unusable signals.

3-3. SIGNAL ANALYSIS.

3-4. AURAL AND SPECTRAL ANALYSIS. Means of signal identification used with the radio intercept facility include aural and spectral analysis. Spectral analysis is accomplished by using receivers with panoramic adapters. Aural analysis is achieved simply by listening.

3-5. TIME AMPLITUDE ANALYSIS. Signals can often be more easily recognized by time amplitude analysis. (See A, figure 3-1.) This is accomplished with an oscilloscope having a time sweep base and observing the amplitude variations on its cathode ray tube. (See B and C, figure 3-1.) Because the radio intercept facility is not equipped with time base and vertical amplitude signal analyzing features, the technician must also become familiar with the time-to-frequency relationships in the signal, so that he can recognize them by their spectral character.

3-6. KEYED CARRIER TRANSMISSIONS.

3-7. CONTINUOUS WAVE EMISSION (A1).

a. General. The simplest and probably also the most widely used form of radiotelegraph signaling is cw (continuous wave). However, it is not used for radioteletype. In cw, the rf signal (carrier) is on only when the key is down. The rf is therefore transmitted in short and long bursts (pulses), with "off" periods in between, corresponding to dots and dashes, respectively. (See B, figure 3-1.) The rf is a sinusoid of constant amplitude, cycle-to-cycle, during the burst (A, figure 1-3.) with a gradual buildup and decay at the beginning and end of the pulse. (See C, figure 3-1.) If listened to through a receiver, the signal would sound like a

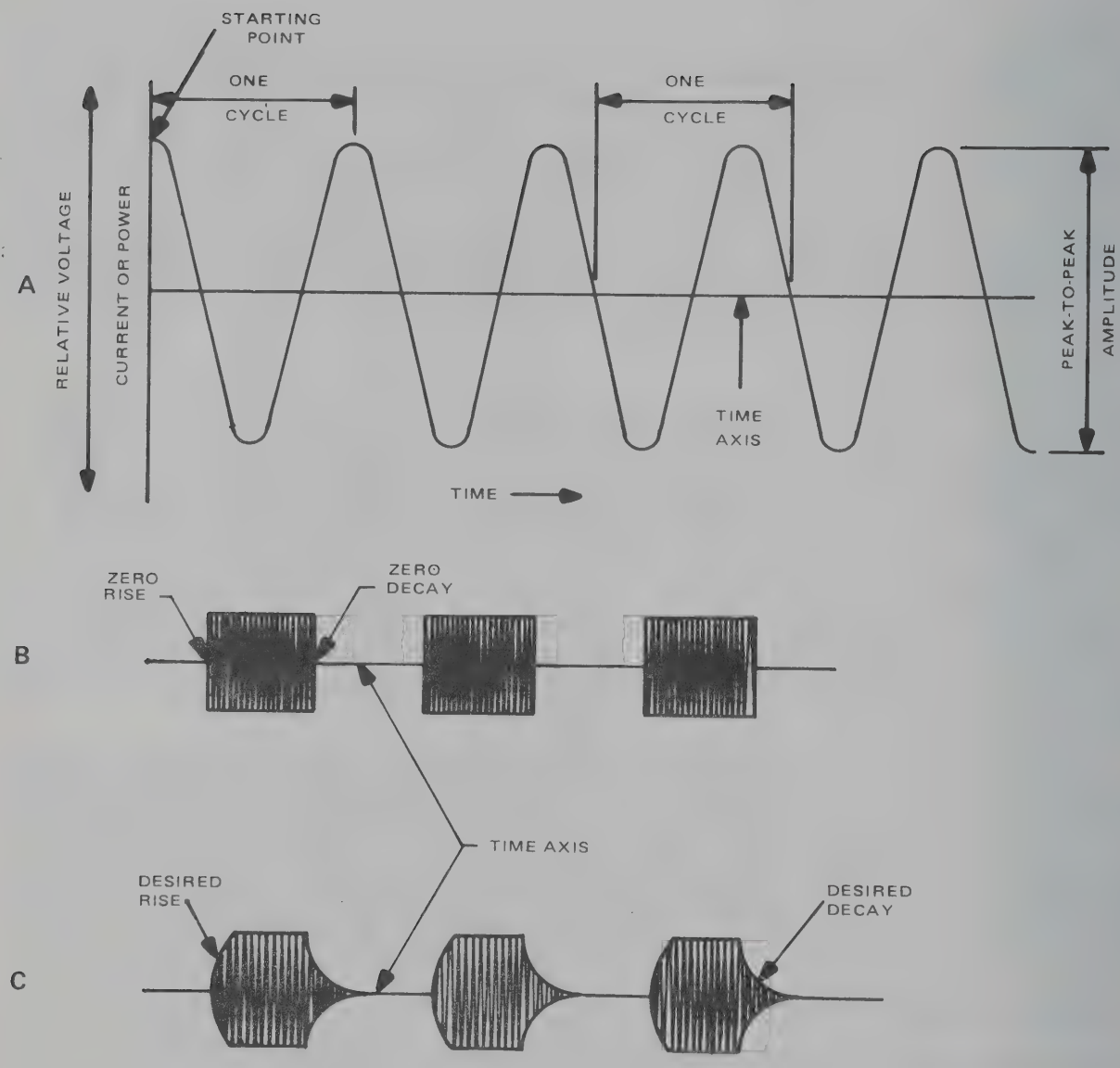


Figure 3-1. Amplitude Versus Time RF Sine Wave, and CW Oscilloscope Presentations

succession of thumping sounds, not distinct dots and dashes. The sounds heard are produced mainly by the transitions from off to on and vice versa. To make code characters distinguishable, an auxiliary signal is injected into the receiver if amplifier so that a beat tone, produced by a bfo, is heard during a pulse. Its frequency may be manually adjusted to vary the beat frequency for best readability. Since an audio frequency tape recorder of the type provided with this radio intercept facility cannot record dc pulses, it cannot faithfully record the code pulses, unless the bfo is employed.

b. Sideband Frequencies Generated by CW Emission. The transmission of rf pulses also produces additional frequencies distinct from the carrier frequency. These components are arrayed about the carrier in sidebands. If the off-on and on-off transitions are rapid, a wide band of frequencies extend above and below the carrier. This is why the transmitted pulses are purposely rounded somewhat, i.e., to minimize the bandwidth over which the side frequencies extend. It is not obvious that sidebands exist and one might assume that only the carrier frequency is present, however, side frequencies must exist, mathematically speaking, and their actual existance can be shown by using spectrum analysis. The side frequencies are spaced at intervals of the keying frequency, above and below the carrier frequency. The bandwidth is thus proportional to the keying frequency. If the transmitted pulse is rounded, as is usually the case, very few side components are produced. (See C, figure 3-1.)

c. Spectrum Analysis of CW Emission (A1). In viewing the spectrum, only the carrier component would be visible, appearing at a blinking single line. The side components would not be visible because of their close proximity to the carrier. By those having a knowledge of the Fourier series and trigonometry, it can be seen that two side frequency components are produced about the carrier frequency, one above and one below, for each component in the modulating (keying) wave. The cw radiotelegraph method thus has the advantage of requiring very little band (channel) space; but, it is relatively susceptable to radio noise and fading, and is not satisfactory for radioteletype use.

3-8. MODULATED CONTINUOUS WAVE EMISSION (A2).

a. General. Modulated continuous wave (mcw) is similar to cw, being transmitted in short and long rf pulses. (See D, figure 3-2.) However, the rf is amplitude modulated by an audio frequency signal (sinusoidally), during the pulse. (See A and B, figure 3-2.) The theory applying to cw also applies to mcw, extended somewhat due to the tone modulation. The spectrum of a continuous sine wave, amplitude modulated by another sine wave, has two components arrayed about the carrier frequency. (See C, figure 3-2.) One component is above and the other is below the carrier in frequency, each spaced by the modulation frequency.

b. Sidebands Generated During MCW Emission (A2). In the case of a pulsed-tone modulated wave, as with cw, the sidebands extend from the carrier beyond the limits of plus and minus the modulation frequency because of the combined effects of the sinusoidal modulation and keying pulse components. However, the modulating frequency is normally so much higher than the keying frequency that its effect predominates. If viewed on a panoramic display, a blinking carrier component with a pair of blinking side components would likely be visible.

c. Spectrum Analysis of MCW Emission (A2). Since information is actually conveyed only in the sidebands, and not at all by the carrier, it is possible to eliminate the carrier and one sideband completely and still transmit the information. This

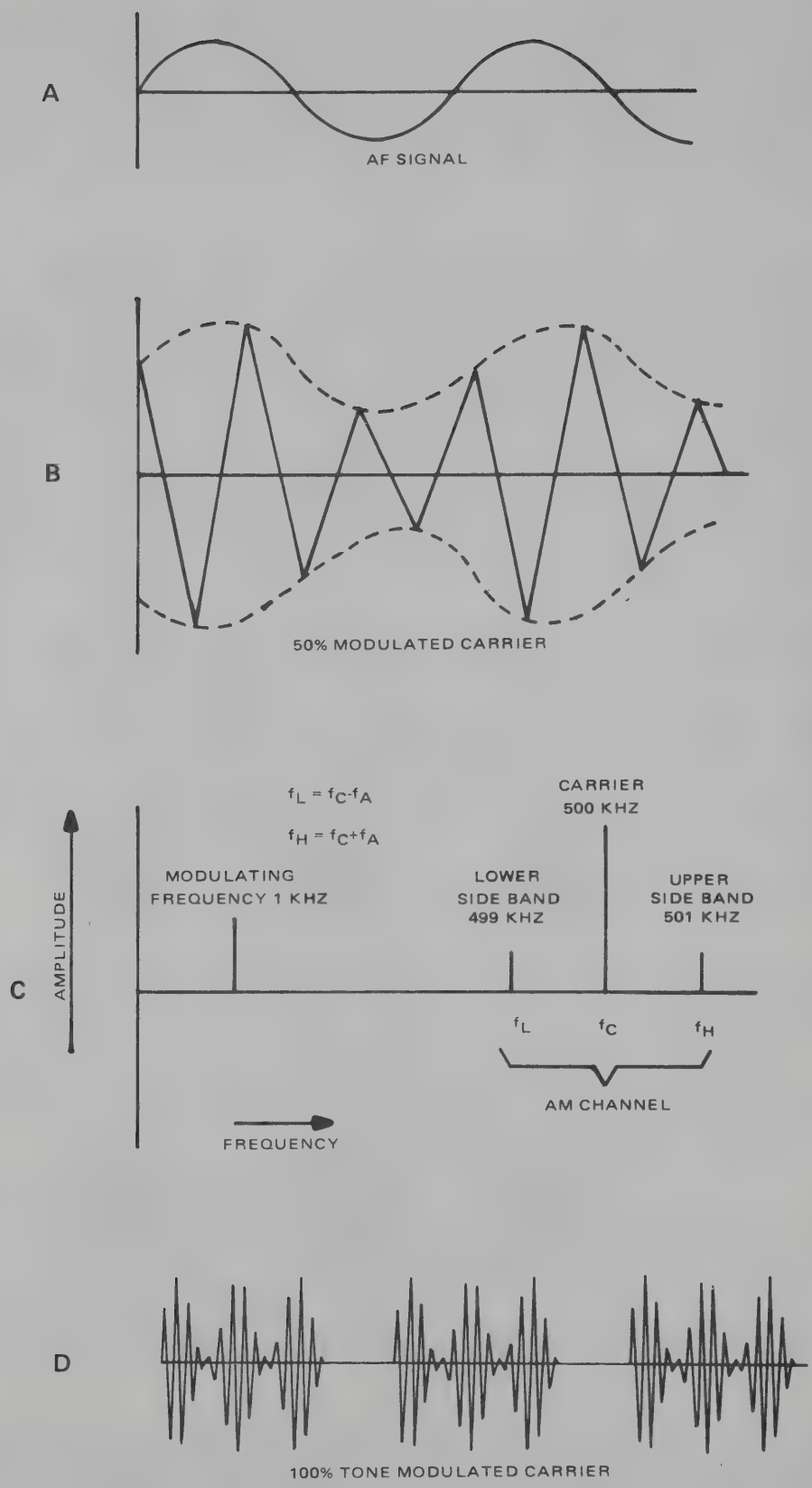


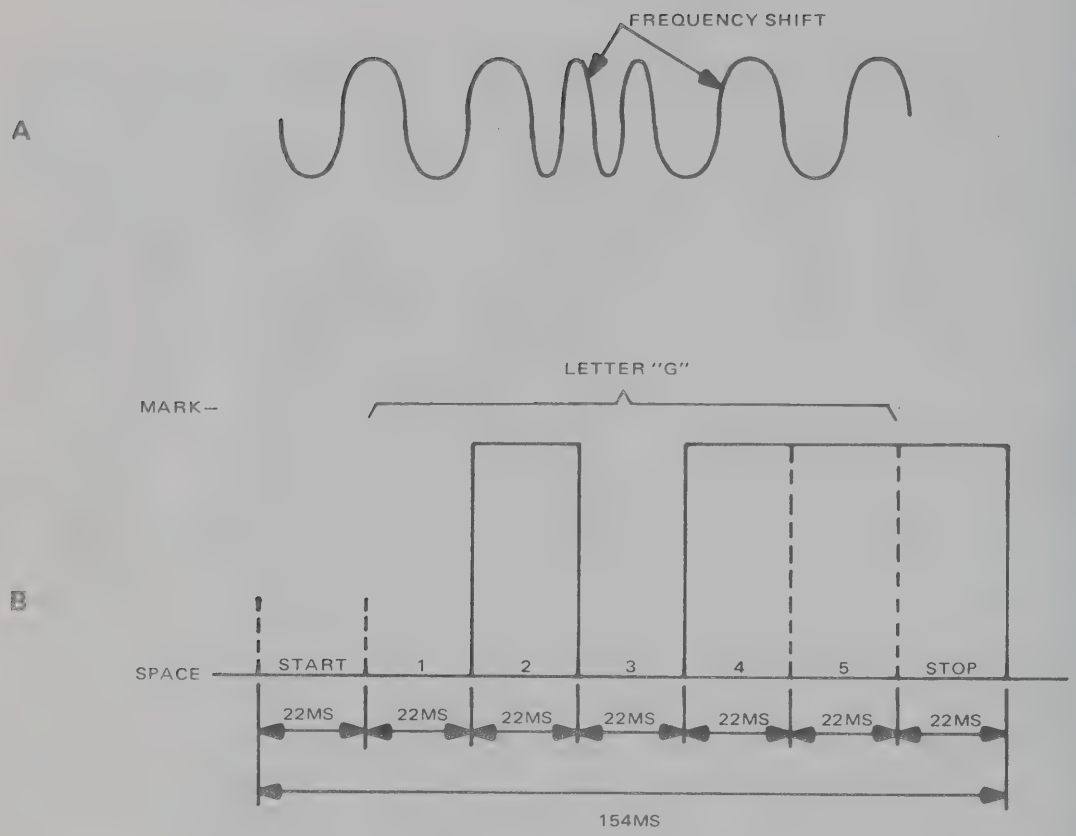
Figure 3-2. Typical MCW Signal Representations

is the well known single sideband system (ssb). In an ssb system, the carrier frequency must be reinserted by the receiver to facilitate detection. Both sidebands may be sent without the carrier, but, in that instance, the carrier must be reinserted in exactly the same phase and frequency as the original, greatly complicating the system. An ssb mcw signal viewed on a panoramic display would appear as a single blinking line representing the side component.

3-9. FREQUENCY-SHIFT KEYED TRANSMISSION.

3-10. FREQUENCY-SHIFT KEYED EMISSION (F1). Frequency-shift keying (fsk) is frequency modulation applied to radiotelegraphy. Unlike cw telegraphy, the rf is transmitted continuously and only the frequency is shifted. (See A, figure 3-3.) The simplest of the fsk methods (F1) is to alternately transmit two preassigned values of carrier frequency, one for space, the other for mark. The carrier shifts in this method represent the corresponding code pulses. (See B and C, figure 3-3.) In fsk, one might assume the required rf bandwidth to be simply the limits set by the two frequencies themselves, but this is not exactly true. The carrier frequency transitions cause additional components to appear beyond the limits of the carrier shifts. If the keying is relatively abrupt, the extent of sideband generation is large. If the keying transitions are rounded, sideband generation is less extensive. Sideband generation is not dependent upon abruptness alone, however, but also upon keying frequency. In functional systems, the frequency shift is much larger than the keying frequency, and the keying wave is sufficiently rounded, that the transmission band does not extend much beyond the shift limits. The principal spectral components are just the two preassigned carrier frequencies. If viewed on a panoramic receiver, a single line shifting back and forth would be visible. A better understanding of fsk and other fm methods can be had if one is familiar with the Fourier series and Bessel functions. Mathematically, the keying wave can be represented by a Fourier series of sinusoidal components. Each of these components causes an array of components to be generated about the rf carrier represented by a Bessel series. This is a rather complicated process, which is to say that, for each component in the keying wave, an infinite series of side frequencies are generated. Only those near the carrier frequency are significant; however, FSK has noise and fading immunity advantages over cw telegraphy. The advantage accrues mostly to amplitude limiting in the receiver, which erases much of the effect of noise and fading.

3-11. MODULATED FSK EMISSION (F2). A widely used radioteletype method is audio frequency shift keying. Two audio carrier frequency tones are sent on an fm carrier alternately, one for mark, the other for space. The carrier center frequency is not shifted as in the simpler F1 emission; the modulating frequency is shifted instead. This provides a positive means of identifying marks and spaces, and is a system having very high inherent noise immunity. In audio fsk, the sidebands are controlled by the audio frequency modulation and the abruptness with which each comes on and off. Since in a practical system the modulation envelope is rounded, the contribution to bandwidth by the transitions is not great. In tone modulation, the carrier frequency swing (deviation) is a matter of adjustment and could be made large or small, but the spectral characteristics of the sidebands are dependent upon the deviations. The (Bessel) components lying in bands on each side of the carrier frequency always occur at increments of the modulating frequency. If the frequency deviation is large compared to the modulating frequency, as is usual, there will be numerous significant components out to the frequency deviation limits and somewhat beyond. Past that, the outer components are relatively insignificant and are usually eliminated altogether in the transmitter. If the frequency deviation is comparable to (or even less than) the modulating frequency, the two components at



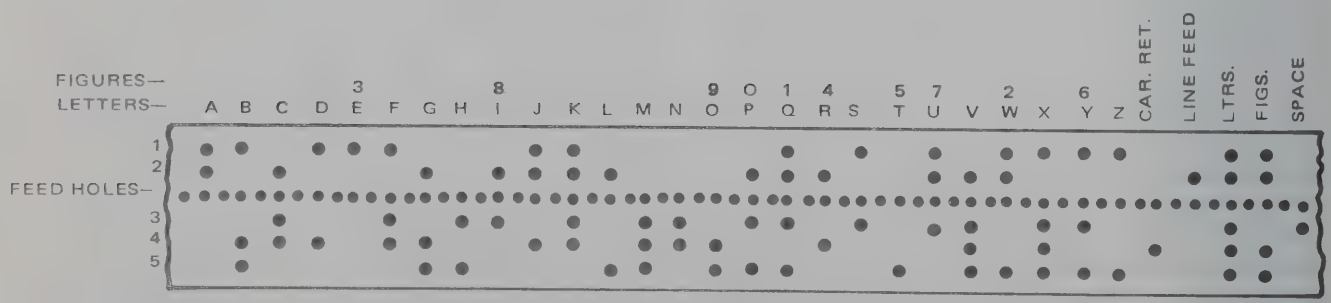


Figure 3-3. Frequency Shift Keying, 60-wpm Pulse Sequence, and Teletypewriter Code Applicable to AN/TGC-14A(V)

plus or minus one modulating frequency increment from the carrier will predominate, and those beyond are insignificant. The side components in all frequency modulation systems are not symmetrical, amplitude-wise, for each increment about the carrier frequency. In fact, some may be zero, and others may be of reversed phase from their opposite number. While this derives mathematically, such is also obviously necessary to account for progressive advancing and retarding of the base line crossings in the transmitted wave during modulation.

NOTE

In a conventional amplitude modulated wave, the base line crossings always occur at uniform time increments due to symmetry of the side components.

The audio fsk spectrum appears as a number of lines of random height, with a glittering shifting of heights and positions during keying. The audio fsk method has another advantage over other methods in addition to noise immunity. This advantage is the ease with which several information channels may be simultaneously sent (multiplexed) on a single rf channel. The use of audio frequency modulation with separate frequencies for mark and space makes this possible. Multiplexing is accomplished simply by assigning space and mark frequencies in non-overlapping frequency pairs, which in practice are usually spaced a fixed increment apart over the audio band used, most often 850 Hz.

3-12. METHODS OF INTERCEPT.

3-13. SIMPLEX WORKING. Simplex working involves one or more stations working with each other on the same frequency. To copy this type working it is only necessary for the operator to employ one receiver and one track of a recorder. If reception is bad and the signal copied is below 30 MHz, the operator may find it necessary to use both rf receivers to obtain the best possible signal. A preferred method in doing this is to tune both hf receivers to the same frequency, and then copy with the receiver control switch on the operator's control panel set on A & B function. This setting will compensate for signal drift, poor reception, and weaker receiving equipment, by always allowing the operator to be able to hear the stronger of the two signals. This method can always be used if the type of signal is cw, mcw, am, fm, or any other signal the operator has trouble in receiving.

3-14. COMPLEX WORKING. Because complex working involves two or more stations working on different frequencies, it is necessary for the operator to be able to copy as many of these frequencies with minimum effort. If both signals are in the hf spectrum, the better method is to tune one hf receiver to the signal that has been determined to be the control frequency, and the other hf receiver to the signal that has been determined to be the frequency that is in communication with the control frequency. After each receiver has been tuned to the proper signal, it is then only necessary to set the receiver control switch to A & B to be able to hear both stations at the same time. It is important to remember that when both signals are to be taped, the other position sharing the same recorder will not be able to tape anything because both recorders will be in use by one operator.

3-15. DUPLEX OPERATION. Duplex operation differs from simplex and complex working in that traffic flows in both directions at the same time. Duplex operation interception involves two separate intercept operators, both copying information on different frequencies between each of the two stations at the same time. These operators must be able to copy traffic and simultaneously exchange technical information verbally to assist in intercepting all transmissions.

3-16. ANTENNA SELECTION.

3-17. ANTENNA INPUTS. This radio intercept facility has four antenna inputs. (See figure 1-6.) These inputs are wired inside the shelter in such a manner that each of the four inputs is used either by only one receiver, or at most, two of the same type receivers, except for the whip antenna. The whip antenna is connected by inherent design to each of the eight hf receivers. The four antenna inputs to the intercept facility reading left to right and top to bottom on figure 1-6, are the whip antenna (E1), the L/P antenna (E2), the long wire antenna (E3), and L/P antenna (E4).

3-18. ANTENNA CONNECTIONS.

a. Whip Antenna. The omnidirectional hf whip antenna (select 1) is connected as shown in figure 3-4.

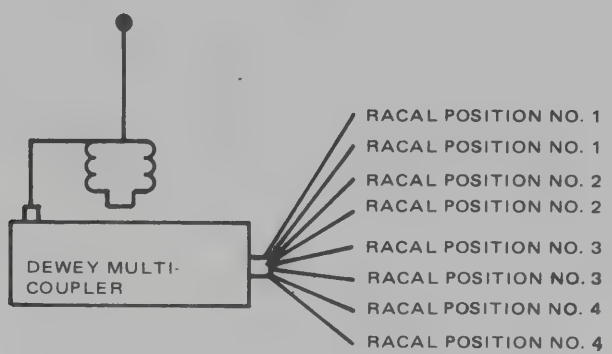


Figure 3-4. Connections, Omnidirectional HF Whip Antenna

b. Log Periodic Antenna Number 1. One of the two log periodic (L/P) antennas (select 2) is connected to the two vhf/uhf receivers in operator positions 1 and 2 as shown in figure 3-5.

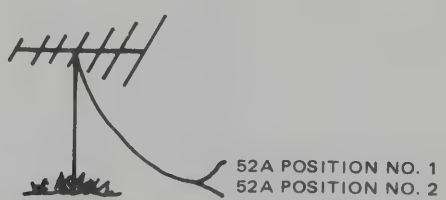


Figure 3-5. Connections, Log Periodic Antenna No. 1

c. Long Wire Antenna. A long wire antenna (select 3), if used with this specific intercept installation, can be switched to the vhf/uhf receivers at operator positions 1 and 2. It can be similarly switched to positions 3 and 4 as shown in figure 3-6, provided only two positions use the antenna simultaneously.

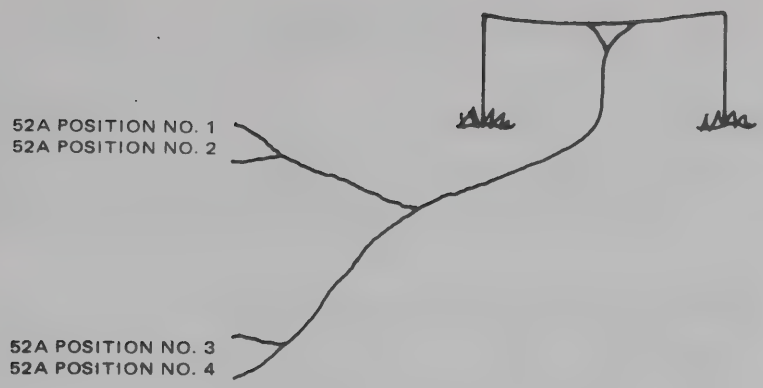


Figure 3-6. Connections, Long Wire Antenna

d. Log Periodic Antenna Number 2. The second log periodic antenna (select 4) can be switched to the remaining two vhf/uhf receivers as shown in figure 3-7. (Refer also to subparagraph b above.)

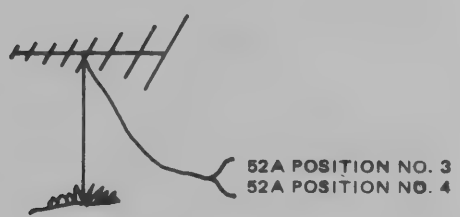


Figure 3-7. Connections, Log Periodic Antenna No. 2

3-19. TELETYPEWRITER OPERATION.

This radio intercept facility is designed so as to provide maximum flexibility in the use of equipment. Although the teletypewriter installation is equipped to receive and copy rtty (radio teletypewriter signals) as stated earlier in this manual, the primary function of the machines is that of monitoring the quality of transmissions being intercepted. Normally the teletypewriter machines are connected to a rear echelon facility by means of landlines connected to the two teletypewriter connections labeled TTY in figure 1-6. Alternate connections could possibly be made between two intercept facility vans for inter-van communication.

3-20. TELEPHONE OPERATION.

Figure 1-6 shows the connecting terminals for external telephone connections. Telephone lines terminate inside the shelter at the supervisor's position.

SECTION II

CONTROLS AND INDICATORS

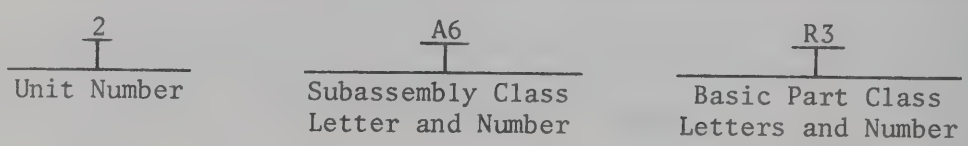
3-21. INTRODUCTION.

This section lists the operating controls and indicators, describes their functions, and provides instructions for their use in the operation of the radio intercept facility.

3-22. USE OF UNIT NUMBERING METHOD FOR REFERENCE DESIGNATIONS.

To simplify references to specific racks, subassemblies, basic parts, diagrams, and circuit elements, the unit numbering method of assigning reference designations is used (DOD Standard Reference Designations, USAS Y32.16-1968/ANSI Y32.16). A "complete reference designation" includes reference designations for units, subassemblies, and basic parts, as shown in the diagram in paragraph 3-23.

3-23. IDENTIFICATION PROCEDURE. Figure 3-8 depicts the use of the unit numbering method. Units, which are a collection of basic assemblies, are numbered sequentially from left to right. In the case of the radio intercept facility, units 1, 2, and 3 comprise console set 1; and units 4, 5, and 6 comprise console set 2. Unit 7 is the air conditioner; unit 8, the antenna coupling unit; unit 9, the supervisor's panel; and unit 10, the power distribution panel. The subassemblies of each unit are further broken down into item class letters (see section 8 of USAS Y32.16-1968), and a number, starting from upper left and proceeding from left to right, and top to bottom. Basic parts to subassemblies would also be identified by an item class letter and a number. A typical example of this complete reference designation follows:



2A6R3 -- resistor 3 of subassembly 6 in unit 2.

3-24. UNITS COMPOSING THE RADIO INTERCEPT FACILITY. In figure 3-8, the units composing the radio intercept facility are numbered from 1 through 10. The subassemblies, in accordance with paragraph 4.1.1 of Y32.16, are all identified by the item class letter "A" (assembly separable or reparable) followed by a sequential number. Basic part designations are not indicated in figure 3-8. When the partial reference designation (unit and subassembly) or the complete reference designation (unit, subassembly, and part) are known, figure 3-8 can be used to determine the unit order and the precise location of the subassembly. Cable storage compartments, located to the left or right of each radio intercept operator (see figure 1-3), are not given a unit number because they are of no electronic consequence.

3-25. EQUIPMENT START AND PERFORMANCE CHECKLIST.

This paragraph provides guidelines for starting procedures and for overall performance checks. All "unit" references refer to the unit numbering for reference

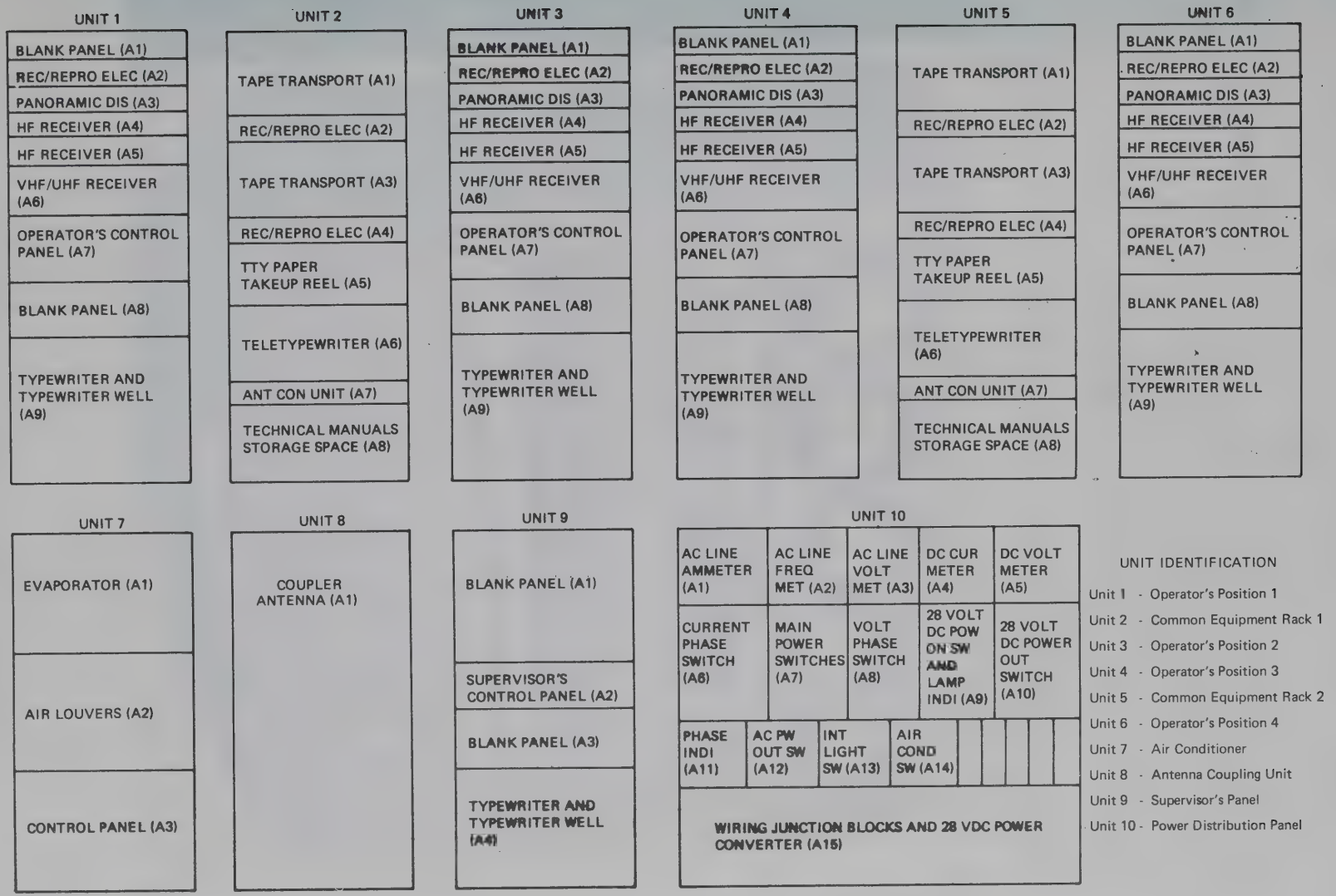


Figure 3-8. Reference Designations for Equipment Unit Identification

designations as shown in figure 3-8. An example of a reference designation as used in this manual is 1A4. This refers to the fourth assembly in the first unit (rack).

NOTE

Ensure that the radio intercept facility is connected to a source of alternating current and the antenna and antenna control cables are properly connected.

3-26. POWER DISTRIBUTION PANEL. Accomplish the following actions at the power distribution panel (figure 3-9) to energize the radio intercept facility:

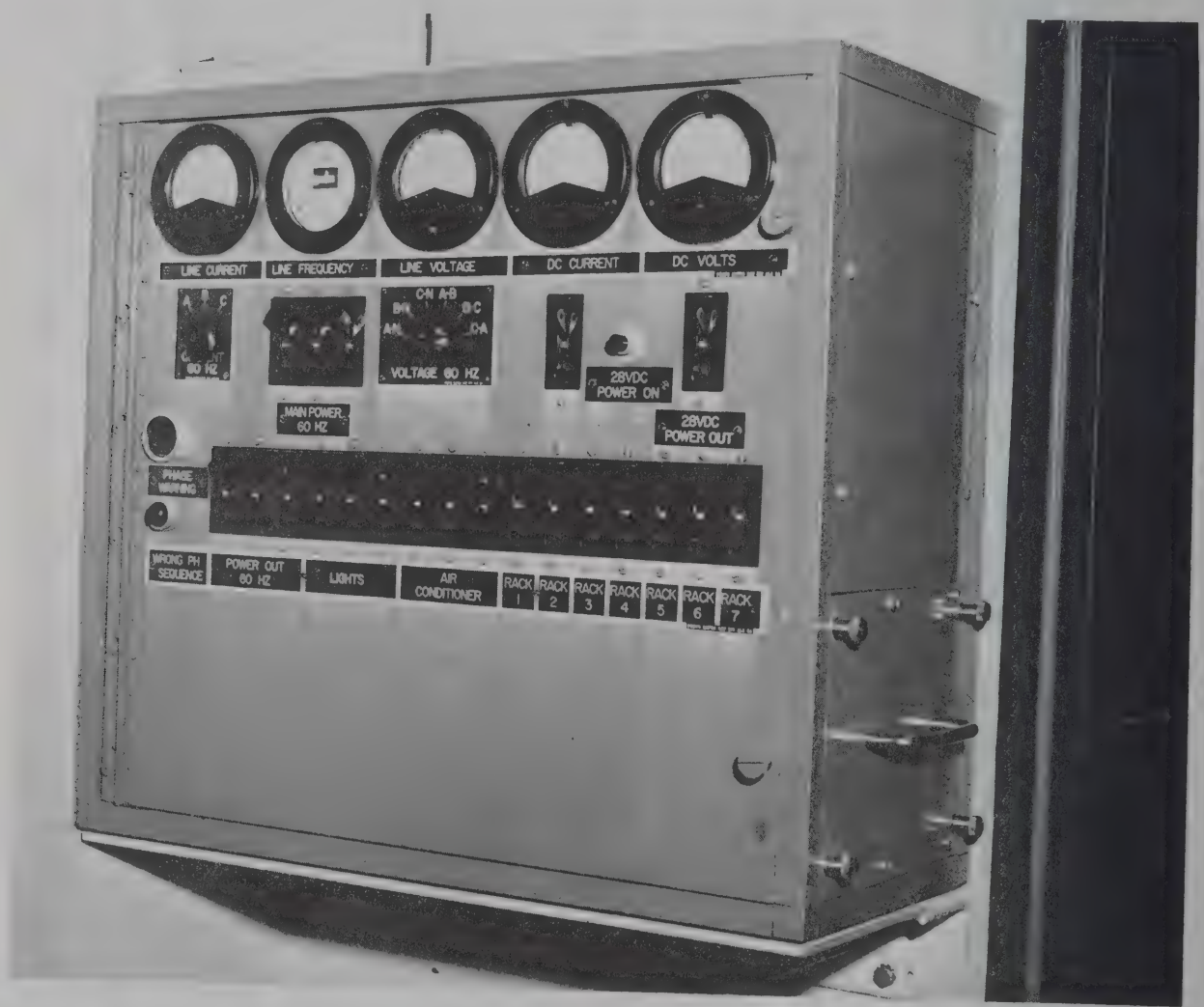


Figure 3-9. Power Distribution Panel Controls

a. Turn on the main circuit breakers and lights. Check the wrong phase sequence lamp, the line frequency meter, and the line voltage meter indications on the power distribution panel.

b. Energize the 28-vdc power supply. Make sure the associated lamp lights on the power distribution panel.

c. Turn on individually the seven rack switches (figure 3-9) on the power distribution panel, starting with rack 1. These seven switches control the following equipment:

1. Rack 1 switch controls operator position number one (unit 1, figure 3-8).

2. Rack 2 switch controls both recorder/reproducers between operator positions one and two (unit 2, figure 3-8).

3. Rack 3 switch controls operator position number two (unit 3, figure 3-8).

4. Rack 4 switch controls operator position number three (unit 4, figure 3-8).

5. Rack 5 switch controls recorders between operator positions three and four (unit 5, figure 3-8).

6. Rack 6 switch controls operator position number four (unit 6, figure 3-8).

7. Rack 7 switch controls the signal splitter and coupler (unit 8, figure 3-8).

3-27. ENVIRONMENTAL CONTROL. Energize the air conditioner (unit 7, figure 3-8). Alternately set the selector switch (figure 3-10) to the COOL then to the HEAT position. Vary the thermostatic temperature control while in both positions. Ensure that the air conditioner transfers from cooling to heating mode and that the thermostat functions properly. While in the cooling mode, ensure that the condensation drain works.

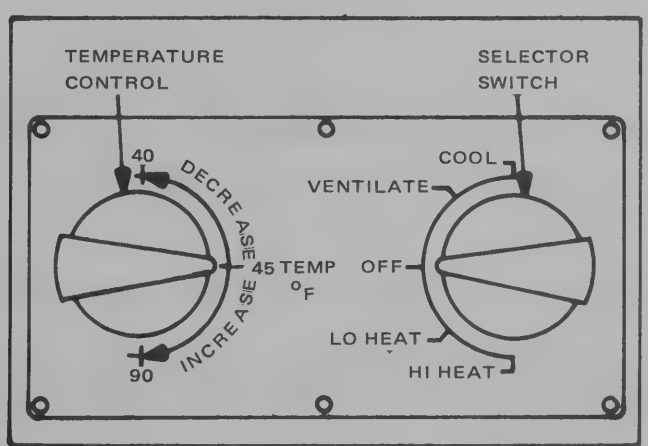


Figure 3-10. Air Conditioner Controls

3-28. EQUIPMENT RACKS. Energize all equipment in each rack (figure 1-3) of the four operator positions. Allow time for warmup. Set all hf receivers and vhf/uhf receivers to an authorized or an active frequency (units 1, 3, 4, and 6, figure 3-8).

3-29. OPERATOR POSITION CHECKOUT. (See table C-11.) To determine whether the equipment in an operator's position is functioning, perform the following actions. (See the appropriate reference designations in figure 3-11 and separate figures as indicated in the checkout steps that follow.)

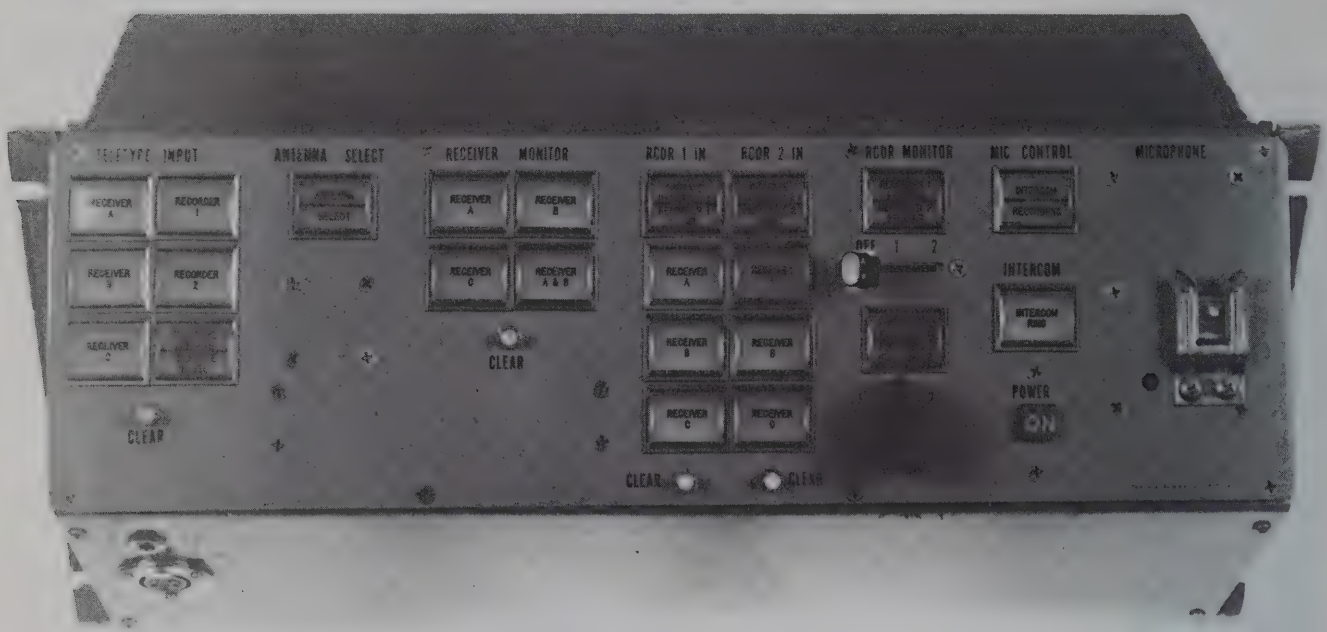


Figure 3-11. Operator's Position Controls

a. Check functions of receiver A (1A4, figure 3-8; and figure 1-7) and return it to its preset frequency as indicated in paragraph 3-32.

b. Adjust panoramic display RA6366 (1A3, figure 3-8; and figure 1-11) for signal display.

c. Check functions of receiver B (1A5, figure 3-8; and figure 1-7) and readjust to preset frequency.

d. Check functions of receiver C (1A6, figure 3-8; and figure 1-12) and readjust to preset frequency.

e. Check typewriter (1A9, figure 3-8) for normal operation of all functions.

f. Check recorder 1 (1A2, 2A1, 2A2, figure 3-8; and figures 1-13 and 1-14) for normal operation with use of front panel controls.

g. Check recorder 2 (3A2, 2A3, 2A4, figure 3-8; and figures 1-13 and 1-14) for normal operation with use of front panel controls.

h. Check antenna pedestal (figure 1-22) for proper operation by operating azimuth and polarization switches on antenna control (figure 1-20).

i. Check antenna controls (2A7, 5A7, figure 3-8; and figure 1-20) to ensure that dials reflect actual positions of the log periodic antenna.

j. Check operation of operator's control panel (1A7, figure 3-8; and figure 1-18) as follows:

NOTE

Operator one and operator two share one teletypewriter.

1. Teletypewriter input:

(a) Depress TELETYPE OPERATE SWITCH. Normal indication is that a TELETYPE IN USE lamp lights. This shows that operator one has taken control of the teletypewriter machine.

(b) Observe the TELETYPE IN USE lamp at operator position number two (3A7, figure 3-8). It should be lit telling operator number two that the teletypewriter machine he shares with operator number one is in use.

NOTE

Only one of five sources can input to the teletypewriter machine at any one time.

(c) Press the RECEIVER A switch. Note that the switch lights up if operation is normal. Press RECEIVER B switch. Note that RECEIVER B switch lights, and RECEIVER A switch lamp goes out as the switch pops up to its normal position.

(d) Check each switch for input to the teletypewriter. All switches should release when a different one is depressed.

(e) Press the CLEAR pushbutton switch. Normal sequence of events is that all TELETYPE input switches release and all associated lamps go out.

2. Antenna Select:

(a) Press the ANTENNA SELECT switch.

(b) Check for change from long wire to log periodic antenna.

3. Receiver Monitor:

(a) Depress RECEIVER A switch. Check headset for signal from receiver A (1A4, figure 3-8).

(b) Depress RECEIVER B switch. RECEIVER A switch should release. Check headset for signal coming from receiver B (1A5, figure 3-8; and figure 1-7).

(c) Depress RECEIVER C switch. RECEIVER B switch should release. Check headset for signal from receiver C (1A6, figure 3-8; and figure 1-12).

(d) Depress RECEIVER A & B switch. RECEIVER C switch should release. Check headset for signals from both receivers A and B, respectively.

(e) Depress the CLEAR switch. Normal sequence is that all switches associated with receiver monitoring actually release, and the lamps go out.

4. Recorder 1 Checkout: (1A2, 2A1, 2A2, figure 3-8; and figures 1-13 and 1-14).

NOTE

Operators number one and two share two recorders. The OPERATE lamps show which operator has recorder control, and the IN-USE lamps will light when the other operator is using either recorder.

(a) Depress RECORDER 1 OPERATE switch and RECEIVER A switch. Check for signal input into channel B of the recorder electronics control unit, located directly below recorder number 1, by observing the vu meter.

NOTE

Recorder number 1 is composed of 1A2, 2A1, and 2A2. Channel B is part of 2A2.

(b) Depress RECEIVER B switch. RECEIVER A switch should release. Check for signal input into channel B of the recorder electronics control unit (2A2).

(c) Depress RECEIVER C switch. RECEIVER B switch should release. Check for signal input into channel B of the recorder electronics control unit (2A2).

NOTE

Check operator's control panel in operator's position number 2 (3A7, figure 3-8) to ensure the RECORDER 1 IN USE lamp remains lit while checking out recorder 1 input.

(d) Place MIC CONTROL in the RECORDERS position. Check for signal input into channel A of the recorder electronics control unit (1A2, figure 3-8) by observing the vu meter and monitoring your own transmission with a headset plugged into 1A2, figure 3-8.

(e) Depress the CLEAR switch located beneath all the RCDR 1 switches and verify that all switches under RCDR 1 IN position pop up (the off position) and all associated lamps go out.

5. Recorder 2 Checkout. Recorder number 2 (1A2, 2A3, and 2A4, figure 3-8) is checked out by using the same procedures outlined in preceding paragraph 3-29j4 for recorder number 1. Use switches associated with RCDR 2 for these checks.

6. Recorder Monitor Checkout. The RCDR MONITOR switches enable the intercept operator to monitor inputs to either recorder 1 or recorder 2. Proceed as follows:

(a) Tune a receiver to a broadcasting station on an active band. Activate the RCDR 1 IN switches as outlined in preceding paragraph 3-29j4(a). Set the RCDR MONITOR lever switch from OFF to 1. Ensure that the RECORDER 1 MONITOR lamp lights. Check for signal with headset plugged into bottom left of operator 1 control panel (1A7, figure 3-8).

(b) With a signal input to Recorder 2, check for signal in the Recorder 2 monitor switch position, in the same manner as in paragraph 3-29j6(a), except that recorder number 2 is now being used.

NOTE

The MIC CONTROL switch is a two-sectioned switch. Depressing the switch changes the microphone from intercom to recorders; depressing the switch a second time changes the microphone from the recorders to the intercom. Lamps indicate which mode of control the switch is set in.

7. Microphone Control Switch Checkout:

(a) Depress the MIC CONTROL switch until the intercom section lights, and check for intercom audio in headset.

(b) Check recessed screwdriver gain control on the MIC pre-amp for proper operation.

(c) Depress the MIC CONTROL a second time; the recorder section lamp should light. Check channel A of each recorder for audio input.

NOTE

A receiver must be patched in, to obtain MIC registration on the amplifier.

8. Intercom Ringing Circuit Checkout:

(a) Depress the INTERCOM RING switch and check if operator number 1 intercom lamp lights on the supervisor panel (9A2, figure 3-8).

(b) Depress operator number 1 intercom on supervisor panel (9A2, figure 3-8) and see if intercom switch lights in operator number 1 panel (1A7, figure 3-8).

9. Foot Pedal Control Checkout:

(a) Set the rotary switch beneath the foot pedal lamps to position 1. Step on the foot pedal. Normal sequence is that recorder number 1 (2A1, figure 3-8) will activate.

(b) Move the recorder lever switch to position 2. Check that recorder 2 operates in same manner as recorder number 1 did in previous step.

k. Check out operator position 2 consisting of unit 2 and unit 3, figure 3-8, using the same procedures outlined for position 1. See preceding paragraph 3-29j.

1. Check out operator positions 3 and 4 (units 4, 5, and 6 of figure 3-8) using the procedures outlined for position number 1.

3-30. SUPERVISOR'S POSITION CHECKOUT. (See 9A2, figure 3-8; figures 1-4, 1-19, 3-12; and table C12.)

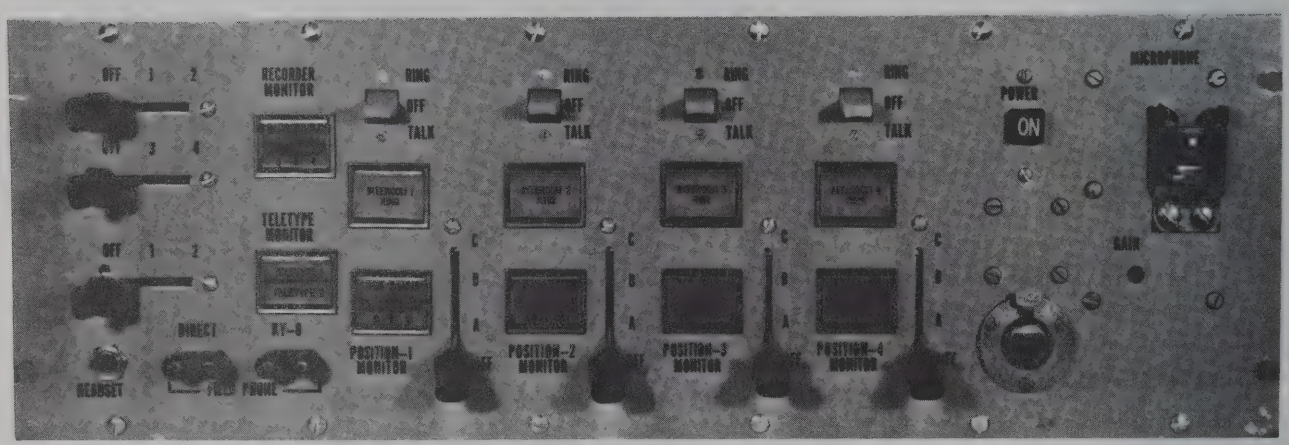


Figure 3-12. Supervisor's Position Controls

a. Monitor all receivers at each operating position for proper signal reception. Note whether the lamp associated with the receiver being monitored lights and goes out as the lever switches are changed from position A to B to C.

b. Adjust volume controls at the receivers being monitored to a comfortable level.

c. Input a different signal to each of the recorders and a teletype signal into each of the teletypewriters by using the appropriate switches on the operator's control panel.

d. Monitor the signals to recorders and teletypes by using the lever switches at the top left of the supervisor's panel, and check all switches and lights for proper functioning as follows:

NOTE

The recorders monitoring circuit consists of two lever switches and a four-sectional indicator lamp. To check for proper audio signal, vary the volume control on the receiver being monitored.

1. With both switches in the OFF position, check for no lights and no audio in headset.

2. Place top lever switch in position 1. Check that lamp is lit in recorder 1 and that proper audio is heard in headset.

3. Place top switch in position 2; recorder 1 lamp should go out. Verify that only the lamp in recorder 2 lights and proper audio is heard in headset.

4. Return top switch to OFF and place bottom switch into position 3. Check for lit lamp in recorder 3, and proper audio in headset.

5. Place bottom switch in position 4. Check for lit lamp in recorder 4 only, and proper audio in headset.

NOTE

The teletype monitoring circuit consists of a three-position switch and a two-sectioned indicator.

6. With the TELETYPE MONITOR switch in the OFF position, check that lights are out and that there is no sound in headset.

7. With the TELETYPE MONITOR switch in position 1, the TELETYPE 1 lamp comes on, and the teletypewriter signal into the converter for use by teletypewriter number 1 (2A6, figure 3-8) is heard in the headset.

8. With the switch in position 2, the TELETYPE 2 light is on, and the teletypewriter signal into the converter for use by teletypewriter number 2 (5A6, figure 3-8) is heard in the headset.

e. Field Phone. Connect two field phones to the equipment and check for proper operation of both lines.

f. Intercom Circuit. These circuits consist of four call lamps and four toggle switches with three positions each. The call light is yellow when activated.

1. Move each switch to the RING position and check the appropriate operator's panel for the signal light.

2. Check each switch (representing a separate operator) on the supervisor's panel for light when each operator places his switch in the RING position.

3. Check each switch for no light in the OFF position.

4. Check each switch for light in TALK position.

5. Check for intercom audio to each operator's position with the switch on the supervisor's panel (9A2, figure 3-8) in the TALK position.

3-31. EQUIPMENT OPERATION.

The remainder of section II is devoted to the initial settings of controls and switches, calibration, and the general operation of the various equipment components supplied with the radio intercept facility.

3-32. HF RECEIVER, RA6217E. (See figure 3-13 and table C-13.)

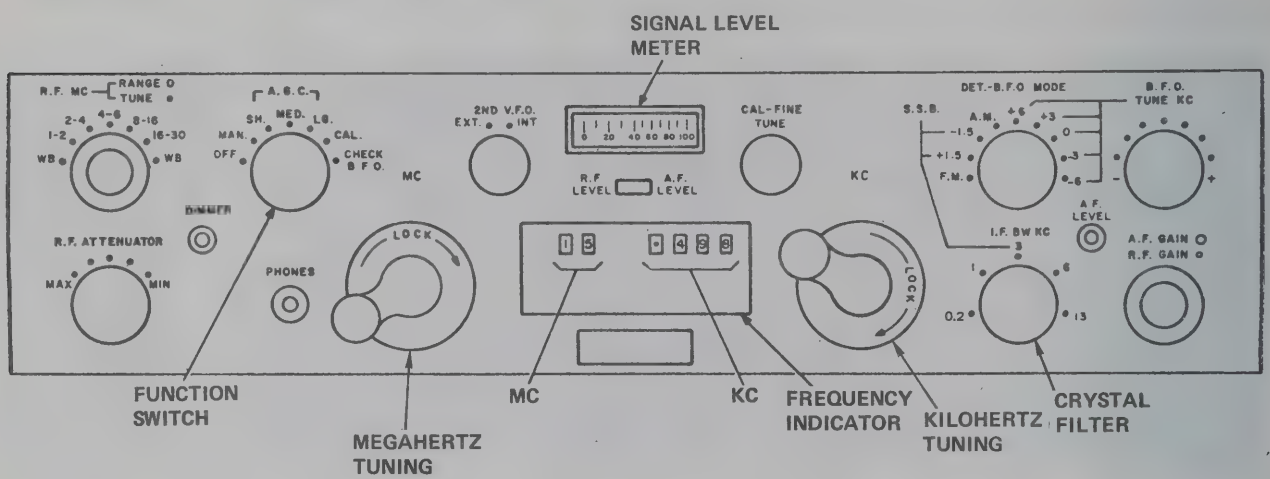


Figure 3-13. HF Receiver Controls, RA6217E

3-33. Initial Turn On. Set the switches and knobs as follows:

Control	Position
RF MC RANGE	WB
RF ATTENUATOR	MIN
Function switch	A.G.C. MED
MC	05
2ND VFO	INT
Meter	R.F. LEVEL
KC	500
DET.-B.F.O. MODE	-1.5
IF BW KC	3
AF GAIN	Midrange
RF GAIN	Fully clockwise

CAUTION

The kHz dial control is a vernier type of dial. Do not spin this dial to gain faster movement over the kHz band. When approaching either the 000-kHz or the 999-kHz reading, fast movement will bend stop clutch, resulting in continuous spinning.

Connect a headset to the PHONES jack and slowly turn the KC dial clockwise. Signals should be heard as the dial is turned. These signals are in the 5-MHz band as denoted by the 05 at the left hand side of the window. The numbers at the right hand side denote in kHz the frequency of the signal in the 5-MHz band. For example, if the numbers showing are 05.582, the receiver is tuned to 5.582 MHz.

3-34. Calibration of Receiver Kilo-Hertz Counter. Set the switches and knobs as follows:

Control	Position
Function switch	CAL
2ND VFO	INT
DET.-B.F.O. MODE	AM
IF BW KC	6
AF GAIN	Midrange
RF GAIN	Fully clockwise
KC	500
Meter	RF LEVEL
CAL-FINE TUNE	Midrange, or adjust for output

Under these conditions the front panel meter should show some deflection and an audio note should be heard from the headset. Adjust the CAL-FINE TUNE control until the pointer on the meter peaks. A null will be heard as the CAL-FINE TUNE knob is turned to change the audio output from a high tone to a low tone. Continued tuning will result in loss of audio output. This quiet region is referred to as a zero beat. Turning the knob still further in the same direction will result in a low tone changing to a high one.

NOTE

The correct calibration point is at the zero beat point.

Turn the KC dial to change the reading to 600. A zero beat should occur at 600 ± 1 kHz. This slight error may be compensated for at this point by setting the reading to 600 and adjusting the CAL-FINE TUNE for a zero beat. Turn the KC dial to the other calibration points not yet covered, 700, 800, 900, 1,000, 400, 300, 200, 100, and 0. At each of these points it should be possible to obtain a zero beat by adjusting the CAL-FINE TUNE knob with the correct reading in the window. This calibration faculty will enable the operator to measure the frequency of the signal he receives by calibrating the kHz dial at the nearest 100-kHz point to the signal frequency he wishes to measure. The accuracy of this measurement will be within 1 kHz.

3-35. Calibration of Receiver Mega-Hertz Counter. The MHz counter of the receiver needs no calibration since a small change in dial position represents a minimum change in actual frequency. If it becomes desirable to determine whether or not the

receiver is alive in certain bands, the following calibration may be performed on the MHz counter. Set the switches and knobs as follows:

Control	Position
RF MC RANGE	WB
RF ATTENUATOR	MIN
Function switch	AGC MED
MC	01
2ND VFO	INT
Meter	RF LEVEL
KC	500
DET.-B.F.O. MODE	-1.5
IF BW KC	6
AF GAIN	Midrange
RF GAIN	Fully clockwise

With a headset plugged into the PHONES jack, noise or signals should be heard. Turn the MC dial towards 02. The noise output should noticeably reduce in passing from 01 to 02 and rise to a peak at 02. This rise of noise at each setting of the MC number indicates that the receiver is live to that band. When tuning this control, the optimum setting is at the peak of the noise output. Check that there is a rise of noise at each setting from 01 thru 29. Due to a drift eliminating loop, the receiver may be used anywhere within the rise of noise area.

NOTE

Although the hf receiver (unit 1A4, figure 3-8) is now ready to receive actual signals, the operator may wish to refer to paragraphs 3-43 through 3-47, concerning the calibration of the panoramic display (unit 1A3, figure 3-8), before proceeding with receiver checkout. Use of the panoramic display also involves manipulation of the hf receiver (unit 1A4, figure 3-8) dials and switches.

3-36. Searching for Signals in Wideband. Set switches and knobs as follows:

Control	Position
RF MC RANGE	WB
RF ATTENUATOR	As desired
2ND VFO	INT
DET.-B.F.O. MODE	0
B.F.O. TUNE KC	As desired
IF BW KC	3
AF GAIN	As desired
RF GAIN	Fully clockwise
Function switch	AGC MED

Set the MC number to the desired MHz band by adjusting for the maximum rise on background noise. Tune the KC control from 0 thru 1,000 kHz. Signals should be heard across the band as the kHz tuning passes over each signal. The form of this audio output will depend on the type of signal being received. It will also dictate which position of the DET.-B.F.O. MODE switch to use and the optimum bandwidth to select once a desired signal has been found.

3-37. Reception of AM Signals. An am signal refers to one which is amplitude modulated. This type of signal normally carries voice or music and is widely used by local radio stations in the 535-kHz thru 1.6-MHz band. International broadcasts will also be found between 6 MHz and 21.7 MHz. Some signals carry voice or music along with a beat note that sounds like a whistle. Set the DET.-B.F.O. MODE switch to AM position. The whistle should disappear leaving the broadcast coming through clearly. The RF LEVEL meter may be used to tune in the signal. If desired, the antenna may also be tuned by adjusting the R.F. MC TUNE control for best signal input according to the meter. The minimum bandwidth setting of the I.F. BW KC control for am signals is 3 kHz, but wider bandwidths will produce clearer sound unless adjacent signals produce interference. The function switch should be set to AGC to reduce the effects of fading. The agc time-constant used is not important for receiving amplitude modulated signals.

3-38. Reception of FM Signals. The FM position of the DET.-B.F.O. MODE switch allows reception of frequency modulated signals. This is a narrow band communications fm and should not be confused with broadcast band fm which is in the vhf bands. The bandwidth of the fm output will be limited by the I.F. BW KC switch setting and should be set to the widest position consistent with the deviation on the fm signal being received. Tune receiver as in am reception.

3-39. Reception of CW Signals. A cw signal refers to one which is a continuous wave signal. In Morse code transmissions, for instance, a continuous wave is switched on and off to produce a series of dots and dashes. To receive this type of transmission, set the DET.-B.F.O. MODE switch initially to the zero position to turn on the bfo. The B.F.O. TUNE KC control should be adjusted to produce a desirable tone. The I.F. BW KC (bandwidth) knob should be set in the narrowest position consistent with this type of signal (either 0.2 kHz or 1.0 kHz) to reduce the effects of interference from adjacent signals. For handkeyed cw, the function switch should generally be used in the MAN position. The RF GAIN control is adjusted counterclockwise for a reasonable audio output, with the AF GAIN control set to midrange. The long agc time constant may also be used if the breaks in transmission are short. For high speed telegraphy, the function switch should be used in the A.G.C. SH position to reduce the effects of fading and to make use of the short discharge time of the agc. The bfo is also used for the demodulation of fsk and facsimile-type signals using associated equipment. When a very stable bfo is required, the +1.5 or -1.5 position of the DET.-B.F.O. MODE switch should be used. The KC control should then be slightly offset to give the desired output.

3-40. Reception of Upper Sideband Signals. This type of signal is essentially an am signal generated with both upper and lower sidebands, but with the lower sideband rejected at the transmitter. These signals may have a full carrier, a pilot carrier, or a suppressed carrier transmitted with the sideband. The DET.-B.F.O. MODE switch should be set to -1.5, the I.F. BW KC switch to 3, and the KC dial tuned to obtain a maximum output at the desired frequency. The resultant output will probably sound garbled and unintelligible. While listening to this output, adjust the CAL-FINE TUNE knob slowly until the signal sounds clear and intelligible. The upper sideband is now tuned in. Any one of the three A.G.C. positions may be used for this type of signal. The RF GAIN control may be used to reduce the receiver noise output when pauses in transmission occur.

3-41. Reception of Lower Sideband Signals. The procedure for this is identical to that for upper sideband (refer to paragraph 3-40) except that the DET.-B.F.O. MODE switch is in the +1.5 position.

3-42. Tuning the Antenna. For reception of signals in the wideband mode, the entire spectrum from 1 through 30 MHz is present at the front end of the receiver. A disadvantage of this is that transmitters near the receiving site feed strong signals into the receiver and tend to block out the weaker or more distant stations. In order to prevent signals in bands (other than the one being selected) from causing interference, an antenna peaking circuit is included in the receiver. When this is correctly set up, only the desired signal and those close to it are admitted into the antenna circuit of the receiver. This antenna peaking circuit is divided into bands and is labeled R.F. MC RANGE. Each of these bands covers a specific range of frequencies as marked on the front panel. For example, 16-30 covers the frequency range from 16 MHz thru 30 MHz. Any frequency within the limits of these basic bands is selected by using the R.F. MC TUNE control. The correct way to use the tune control is to select the desired signal in wideband and then switch to the appropriate band in which the desired signal lies. For example, if a desired signal is found at 12.528 MHz, the R.F. MC RANGE control would be switched to 8-16. The desired signal would probably then be inaudible, but peaking the R.F. MC TUNE control to about midrange would bring the signal back again. The antenna is best tuned to the desired signal when the signal level is at its peak as shown by the signal level meter with the switch in the R.F. LEVEL position.

3-43. PANORAMIC ADAPTER, RA6366. (See figure 3-14 and table C-14.) The panoramic adapter is used with the communication receiver type RA6217E to provide a visual

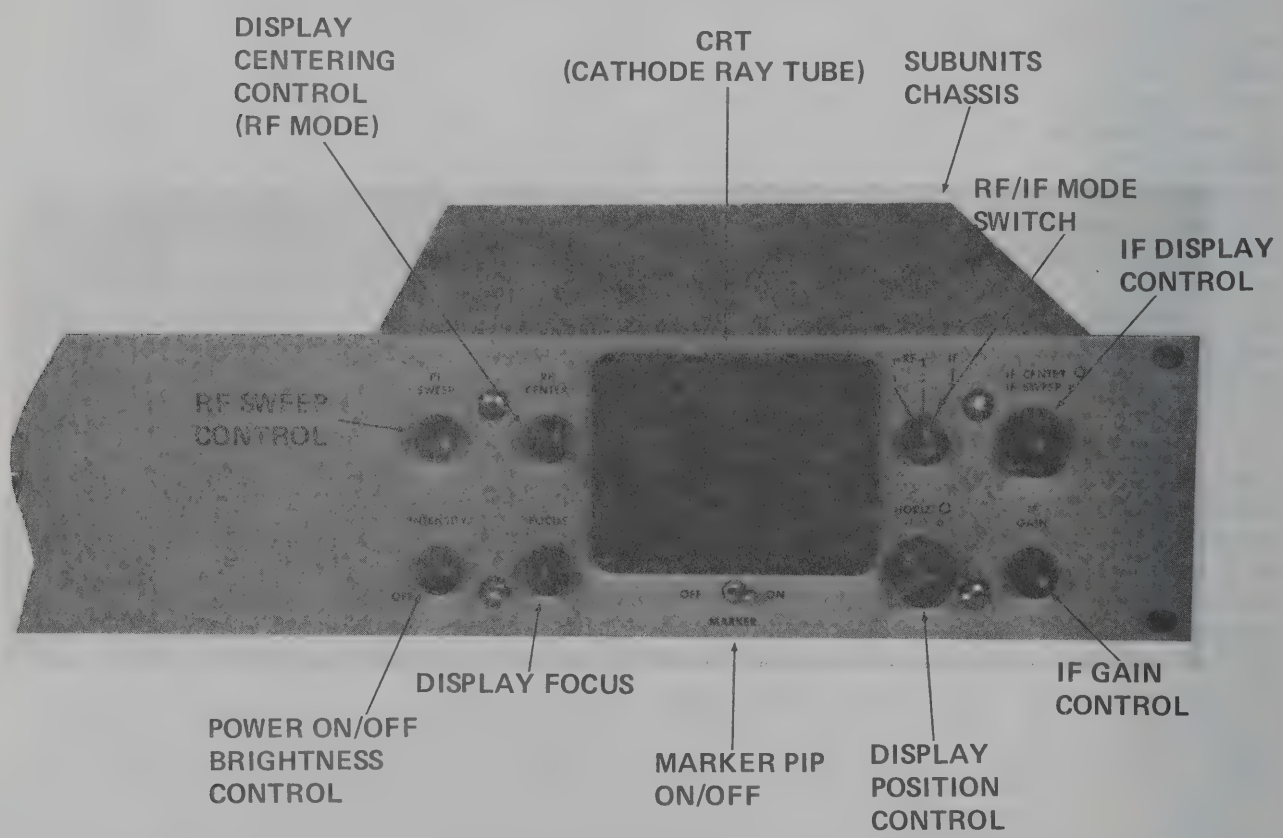


Figure 3-14. Panoramic Adapter Controls, RA6366

display of signals in any selected frequency band between 980 kHz to 30 MHz. The following control settings should be made with the OFF-INTENSITY control set to OFF:

Control	Position
MARKER	OFF
RF SWEEP	Fully clockwise
RF CENTER	Midrange
RF - IF	RF-2
IF SWEEP	Fully clockwise
IF CENTER	Midrange
IF GAIN	Fully clockwise
FOCUS	Midrange
HORIZONTAL/VERTICAL	Midrange

3-44. Initial Turn-on of Panadapter. Make sure that the hf receiver (unit 1A4, figure 3-8) is still turned on, then set the OFF-INTENSITY control on the panadapter to about midrange. A high pitched whine should be heard when the intensity switch is rotated (power is applied). The whine indicates that the crt high voltage unit in the panadapter is operating. Adjust the VERT knob (the smaller of the two concentric knobs) outside the lower left edge of the crt and note whether or not a trace appears along the etched line near the bottom of the crt.

NOTE

Sometimes when the panadapter is switched off and the operator, recognizing at once that he has erred, immediately turns it back on, may find that the trace may not reappear. If this ever occurs, turn the unit to the OFF position and wait approximately 15 seconds for the power circuits to discharge before again switching the unit to the ON position. This should reestablish the trace; however, in extreme cases, it may be necessary (if the above does not work) to operate the OFF-INTENSITY control in rapid fashion from ON to OFF to ON in order to regain the missing trace line.

Adjust the HORIZ knob (the larger of the two concentric knobs) until the trace is well centered on the crt, and the edges of the trace extend to both edges of the crt. Set the MARKER switch (centered directly below the crt) to the ON position. A negative square wave (marker pip) should appear on the face of the crt.

3-45. RF Mode Calibration. Make the preliminary controls and switch settings listed in paragraph 3-43.

a. Verify that the MARKER switch is set to the ON positon, then adjust the RF CENTER control to center the tuning marker on the crt.

b. Switch the RA6217E to CAL. With the receiver kHz dial set to 500 kHz, 11 pips (100-kHz markers) should appear on the trace.

c. Vary the kHz dial on the RA6217E from 0 kHz to 1000 kHz. Ensure that the tuning marker is at the extreme left at 0 kHz, and at the extreme right at 1000 kHz.

d. Tune the hf receiver to a 2.5-MHz signal, and note that a positive pip appears above the marker pulse.

e. With the signal centered, rotate the RF SWEEP control counterclockwise and observe that the sweep width narrows, from 1 MHz down to 100 kHz, i.e., the signal pip opens up but remains visually centered on the crt.

f. Set the RF/IF MODE switch to the RF-1 position, and note that a narrower spectrum signal now appears, but slightly lower in amplitude. This is caused by the crystal filter now being in the circuit.

3-46. IF Mode Calibration. Make the preliminary controls and switch settings listed in paragraph 3-43.

a. Set the MARKER switch to the ON position.

b. Switch the RF/IF switch to IF and note that the marker pulse disappears. Turn the IF SWEEP control fully clockwise. Adjust the IF CENTER control to obtain a response in the center of the trace. Set the receiver IF bandwidth to maximum.

c. Move the KC tuning dial on the receiver, and observe that the two moving pips converge on a fixed one in the center of the trace.

d. Move the KC receiver dial until the largest pip is at the right-hand side of the trace. Note this figure in kHz. Then, move the KC receiver dial until the same pip is at the left-hand side of the trace and note the corresponding figure in kHz. Subtract this figure from the first reading. This will be the maximum sweep width in the IF position.

e. Turn the IF SWEEP control fully counterclockwise. The pip should increase (open up) in width at the center. Slight adjustment of the IF center control may be necessary.

f. Move the KC receiver dial until the response is at the right-hand edge. Note the figure in kHz. Move the KC receiver dial until the response is at the left-hand edge of the trace. Subtract this figure from the first one. This difference should be less than 10 kHz, indicating the minimum sweep width in the IF position.

3-47. Display of Individual Signals. The IF position of the RF/IF MODE selector provides the capability of looking at any discrete portion of the rf spectrum. The following procedure is used to observe a discrete portion of the rf spectrum without moving the RF center control from its correct setting.

a. With the selector switch in the RF-2 position and the MARKER switch ON, tune the receiver exactly to the desired signal of the rf spectrum, using the receiver tuning marker that is displayed on the crt.

b. Set the selector switch to the IF position. The desired signal pip will appear in the center of the crt without the tuning marker. A slight adjustment of the receiver KC control may be necessary to obtain maximum amplitude of the displayed signal.

c. An analysis of the desired signal is then possible by adjusting the sweep width control.

d. The if spectrum display is limited by the if bandwidth of the RA6217E. This means that with the hf receiver in the if wideband position, a 75-kHz spectrum can

be displayed, while in the if narrow bandwidth position, only a 20-kHz spectrum or less is visible on the crt, depending on the specific if bandwidth control setting of the receiver (1A4, figure 3-8).

3-48. TAPE RECORDER/REPRODUCER, AG-500-2. (See figures 3-15, 3-16, and 3-17; and table C-15.)

NOTE

The operational procedures given in paragraphs 3-49 through 3-55 pertain to the fundamental tape recorder/reproducer of the type used in the radio intercept facility. No specific application or use of the tape recorder as hooked-up in the radio intercept facility is implied by those instructions. Specific recorder/reproducer application or use, as installed in the radio intercept facility, is given in table C-11, and paragraphs 3-29j4 through 7, and 9.

Figure 3-15. Tape Transport Controls, AG-500-2

Figure 3-16. Electronic Assembly Controls, AG-500-2

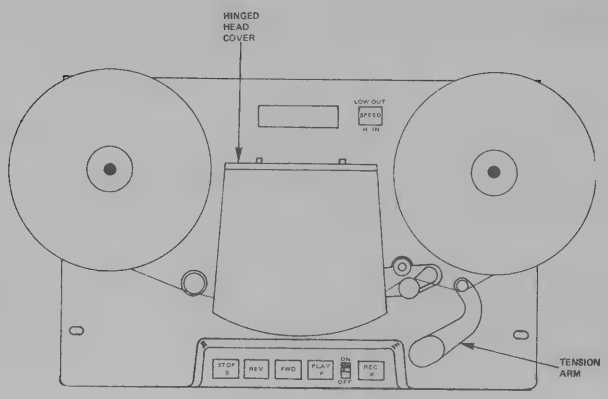


Figure 3-17. Tape Threading Procedure

3-49. Monitoring Facilities. The vu meter provides visual monitoring of record or reproduce signal levels. A headset can be plugged into the PHONES jack, on the front panel of the electronic assembly, for aural monitoring. Note that the signal at this jack is selected by the OUTPUT SELECTOR switch, so that either the record (input) or reproduce signal can be monitored.

3-50. Tape Threading. The tape threading path is shown in figure 3-17. When threading is completed, with the tape anchored to the takeup reel hub, manually turn the takeup reel until the supply reel starts to rotate; this removes all tape slack and ensures that the takeup tension arm is not contacting the safety switch.

3-51. Applying Power. To apply power to the complete tape system, place the power ON-OFF switch in the ON position. This switch is located next to the REC button on the tape deck.

3-52. Tape Speed and Equalization. Tape speed pairs available for this equipment are 7-1/2 and 15 ips; 3-3/4 and 7-1/2 ips; and 15/16 and 1-7/8 ips. Depending on the particular recorder and the speed desired, push the SPEED lever in to select low speed, pull it out to select high speed. At the electronic assembly, reset the EQUALIZATION switch in the HIGH or LOW position, in accordance with the tape speed selected by the button on the tape transport (figure 3-15).

CAUTION

Do not attempt to change tape speed until after power is applied and the capstan is rotating. The speed change mechanism may jam if this precaution is not observed.

3-53. Recording. Use the following sequence for recording:

a. Thread blank tape, or tape recorded with material not necessary to save, on the tape transport (refer to paragraph 3-50).

NOTE

If a previously recorded tape was recorded on equipment using a different head configuration, the old recording might not be completely erased. Also, 15/16 and 1-7/8 ips equipment has no erase head. Bulk erasure of the tape is required in these instances.

b. Apply power to the equipment.

c. Select tape speed and the corresponding equalization. (Refer to paragraph 3-50.)

d. Place the RECORD SELECTOR switch in the RECORD position. If this is two-channel equipment and both channels are to record, place this switch on both electronic assemblies in the RECORD position. If only one channel is to record, place the switch on one electronic assembly in the RECORD position, and the switch on the other electronic assembly in the SAFE position.

e. Place the OUTPUT SELECTOR switch in the INPUT position. Using a rehearsal run or test signal, adjust the RECORD LEVEL control(s) so that the vu meter indicates 0 on most program peaks (maximum peaks can result in an indication of +2 or +3 on the meter).

NOTE

There are two record inputs available on each electronic assembly, each with a record level control. If both are used, monitor a typical signal to be recorded and preset the RECORD LEVEL controls to achieve proper balance and normal record level for the combined inputs.

f. At the tape transport, press the PLAY pushbutton and then the REC pushbutton. Tape will be placed in motion in the record mode. During the record run, the input signal can be compared with the signal being recorded and reproduced from the tape, by turning the OUTPUT SELECTOR switch from the INPUT to the REPRO position and vice versa.

g. At the completion of the record run, press the STOP pushbutton to stop tape motion and remove the equipment from the record mode.

3-54. Reproducing. Use the following sequence for reproducing:

a. Thread the recorded tape on the tape transport (refer to paragraph 3-50). Place the RECORD SELECTOR switch in the SAFE position.

b. Apply power to the equipment. (Refer to paragraph 3-51.)

c. Select the tape speed and equalization (paragraph 3-52) which correspond to those used when the tape was originally recorded. If the four-stack head assembly is employed, position the switch lever on the head. When the lever is full down, the two-track reproduce head is connected; when it is full up, the quarter-track head is connected.

d. Place the OUTPUT SELECTOR switch in the REPRO position.

NOTE

There will be no reproduce output if the OUTPUT SELECTOR switch is left in the INPUT position.

e. Press the PLAY pushbutton. Tape will be placed in motion in the reproduce mode. Adjust the REPRODUCE LEVEL control to achieve the desired output level.

f. To stop tape motion, press the STOP pushbutton.

CAUTION

To prevent accidentally entering the record mode and thus erasing the tape, be sure the RECORD SELECTOR switch on each electronic assembly is in the SAFE position.

3-55. Fast Winding Modes. It is recommended that the hinged head-cover be opened and the tape-lifting mechanism be manually actuated before entering a fast-winding mode. This removes the tape from contact with the heads, and thus minimizes head wear (and cleaning requirements). Either fast-winding mode can be entered whenever tape is threaded and power is applied. Tape can be at a standstill or moving in any mode. To move the tape at fast speed from the supply reel to the takeup reel, press the FWD pushbutton. To move it at fast speed from the takeup reel to the supply reel, press the REW pushbutton. Either fast-winding mode can be entered directly from the other, so in editing or cueing operations the two pushbuttons can be pressed alternately to shuttle the tape quickly to a desired point. To remove the equipment from a fast-winding mode, press the STOP pushbutton. (If tape is allowed to run completely off either reel, the equipment will stop automatically.)

CAUTION

When using a fast-winding mode, do not press the stop and play pushbuttons in such rapid sequence that tape motion cannot stop before the capstan idler clamps the tape to the capstan. If tape motion is not allowed to stop before the play pushbutton is pressed, the tape will probably be broken or stretched.

3-56. ANTENNA CONTROL, C-7120/G. (See figure 3-18 and table C-16.) The C-7120/G (unit 2A7, figure 3-8) controls the azimuth and polarization of the AB-991 Antenna Rotator. The C-7120/G also provides a means for determining antenna direction from within the shelter.

3-57. Orienting the AB-991 Antenna Pedestal to Coincide with C-7120/G Antenna Control. After erection of the AB-991-G it is necessary to orient the control unit to the direction of the antenna. Once the antenna is atop the mast, use a compass to determine the direction the antenna is pointing. When the direction is determined, rotate the dial on the azimuth indicator so that the white triangle at the top of the dial is resting on the correct azimuth. The white arrow should also be pointing vertically. It may be necessary to rotate the AB-991-G prior to installing the antenna to aline the white arrow with the top of the scale. Once these steps are accomplished, a general direction of the signal may be ascertained by rotating the antenna for the loudest reception and then consulting the degree number to which the white arrow is pointing. The AS-1898 normally would be erected in the

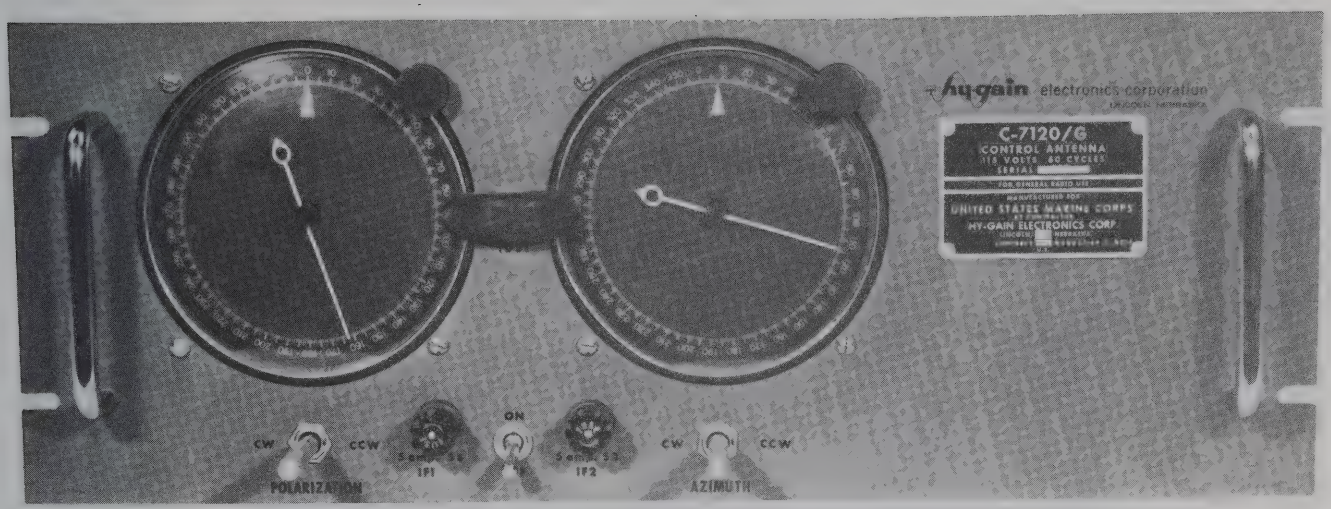


Figure 3-18. Antenna Control Indicators, C-7120/G

horizontally polarized position, therefore the polarization indicator should have zero at the top, and the white arrow should also be facing upward. To change the polarization to vertical, rotate the antenna to either 90° or 270° from the 0° setting.

3-58. VHF/UHF PANORAMIC DATA RECEIVING SET, AN/URR-52A. (See figure 3-19, and table C-17.) The AN/URR-52A Panoramic Data Receiving Set provides a visual display, and am, fm, and cw reception of rf signals in the 30- to 1,000-MHz frequency range in four bands: 30 to 60, 60 to 300, 235 to 500, and 490 to 1,000 MHz. The unit provides four if bandwidths: 20 kHz, 75 kHz, 300 kHz, and 2 MHz. The bandwidth in operation is determined by the control setting on the front panel of the receiver. A single am video or fm video output from the if strip in operation is available depending on the setting of the front panel function switch. The 20-, 75-, and 300-kHz bandwidths contain a beat frequency oscillator which operates in the cw position of the function switch when one of these three bandwidths is selected. A single fine tuning control provides vernier tuning of the tuner in operation. The switching of the four tuners is controlled by the range switch on the front panel. The visual display of the signals is provided by a signal monitor which is an integral part of the receiver.

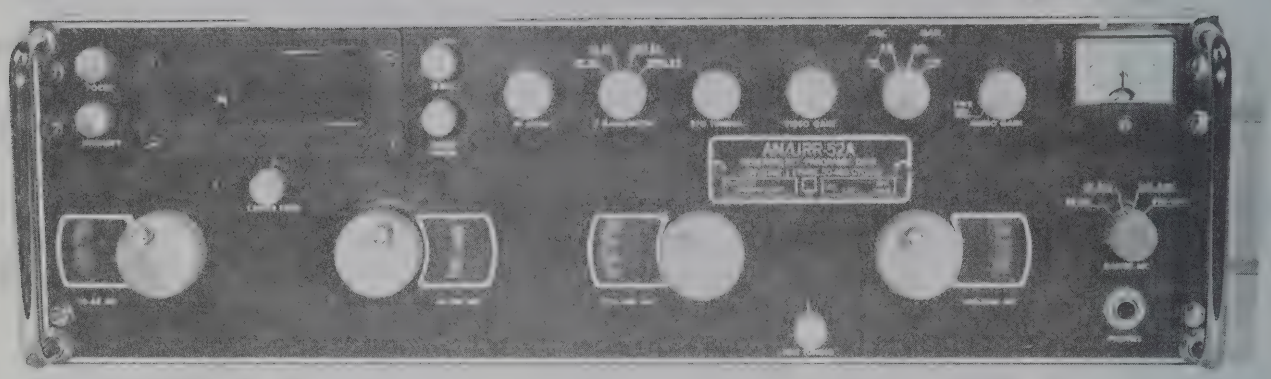


Figure 3-19. VHF/UHF Receiver Controls, AN/URR-52A

3-59. TELETYPEWRITER SET, AN/TGC-14A(V). (See figure 3-20 and table C-18.)

WARNING

Operation of this equipment involves voltages which are dangerous to life. Do not service or adjust the teletypewriter set while it is running unless extreme caution is used and an assistant is present.

3-60. Purpose of Equipment. The teletypewriter sets provide a means of exchanging typewriten page messages between two or more stations which are similarly equipped and connected by suitable transmission media.

3-61. Primary Power Source Options. The teletypewriter sets are adaptable for use with 115 volts alternating current, 60 cycles per second, or 400 cycles per second primary power by a change in the motors.

3-62. Operating Speed Options. The AN/TGC-14A(V) will operate at 45.45, 50, or 75 baud. However, gears for other operating speeds may be obtained from the manufacturer.

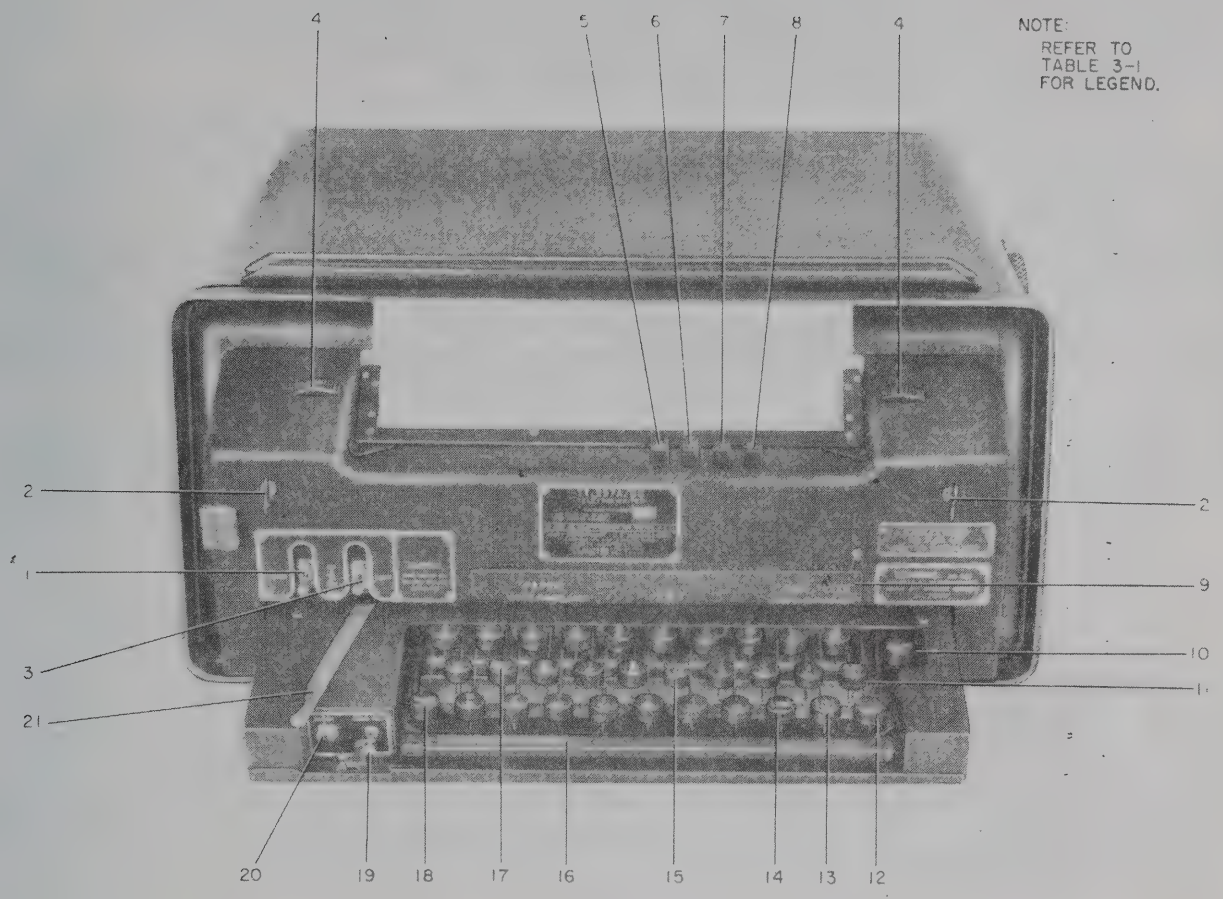


Figure 3-20. Teletypewriter Controls, AN/TGC-14A(V)

NOTE

A baud and Baudot code are not synonomous. The Baudot code is a 5-bit telegraphic code containing start and stop elements. A baud, on the other hand, is a unit of signaling speed equal to the number of signal events per second, i.e., one baud corresponds to a rate of one unit interval per second. The signaling speed (modulation rate) is expressed as the reciprocal of the duration in seconds of the unit interval. For example: If the duration of the unit interval is 20 milliseconds, the modulation rate is 50 baud as shown by the following: $\frac{20}{1000} = \frac{2}{100}$, and the reciprocal $\frac{100}{2} = 50$. (50 baud per second.)

3-63. Operating Mode Options. The teletypewriter sets can be patched for half-duplex (simplex) or full-duplex operation by changing patch cord arrangements. (See figure 1-17.) Refer to paragraph 2-9, TM-03315-15 for a complete description of patching facilities.

3-64. Basic Principles of Operation. The teletypewriter sets provide a means of transmitting and receiving printed intelligence by means of exchanging series of coded pulses with similar equipment. The local teletypewriter set generates a

standard five-level, 7.0- or 7.42-unit, Baudot serial teletypewriter code (B, figure 3-3) which is sent over a transmission medium to a remote teletypewriter set. At the remote station, the teletypewriter set receives, decodes, and prints the transmitted intelligence or performs appropriate functions.

3-65. Description of Controls. Refer to table C-18 for a listing of operator's controls and functions. All index numbers shown in figure 3-20 are referred to in table C-18.

3-66. Description of Indicators. Teletypewriter sets are equipped with two aural indicators: an end-of-line bell to alert the operator that the end of the line is near, and a signal bell that the local operator may use by striking the FIGS key and then the S key to alert the remote operator to a forthcoming message or a desired contact.

3-67. Sequence of Operation. To operate the teletypewriter set, apply the instructions given in section III of TM-03315-15, and listed in subparagraphs that follow.

a. Preliminary starting procedure, paragraph (1).

b. Installation of ribbon, paragraph (2).

c. Installation of paper, paragraph (3).

d. Starting procedure, paragraph (4).

e. Operating procedure and checks, paragraph (5).

f. Stopping procedure, paragraph (6).

SECTION III

OPERATION UNDER SPECIFIC CONDITIONS

3-68. OPERATION UNDER NORMAL CONDITIONS.

Instructions in this section are published for the information and guidance of the personnel responsible for the operation of the radio intercept facility. To operate the radio intercept facility and associated equipment, perform functions indicated in chapters 2 and 3 of this manual.

3-69. OPERATION UNDER UNUSUAL CONDITIONS.

In the event that the radio intercept facility cannot be operated any longer from a stationary location, it is possible to operate from various temporary locations by installing a search antenna on the front of the operating shelter, a whip antenna on the rear, and using portable power generating equipment for primary power. This allows the radio intercept facility to move about at will.

3-70. OPERATION UNDER EMERGENCY CONDITIONS.

If the radio intercept facility must be operated under adverse weather conditions, particularly in high winds, it is recommended that the telescoping masts be lowered as described in paragraph 4-15 of this manual. The log periodic antenna must first be placed in a vertically polarized attitude. When the log periodic antenna has been lowered partially, or entirely to its nested configuration (figure 1-24), proper tensioning of guys should enable the antenna to withstand wind velocities of 100 miles (87 knots) per hour.

CHAPTER 4

MAINTENANCE INSTRUCTIONS

SECTION I

INTRODUCTION

4-1. SCOPE.

Maintenance instructions contained in this manual are limited to regularly scheduled preventative maintenance, daily maintenance, and first echelon maintenance performed by operating personnel. Procedures for maintenance in greater depth are contained in the various instruction manuals for individual equipments and should not be attempted by operating personnel without specific authorization and training.

4-2. MAINTENANCE DEFINITION.

For the purpose of this manual, maintenance of materiel is defined as the action taken to retain materiel in a serviceable condition or to restore it to service. It includes inspection, testing, servicing, and classification as to serviceability with subsequent referral for repair, rebuilding, or reclamation as appropriate.

4-3. FORMS, RECORDS, AND REPORTS.

Records and report forms are necessary in the planning and implementation of equipment maintenance. They are required for consistent inspection procedures; repair parts requirement forecasting; repair parts requisitioning; and economical, effective shop-procedures. All record and report forms are contained in the current edition of TM-4700-15/1_.

SECTION II

OPERATOR'S MAINTENANCE

4-4. DEFINITION AND SCOPE.

Operator's maintenance is maintenance which is the responsibility of, and performed by, the using operators on their assigned equipment. On the radio intercept facility, operator's maintenance is limited to the inspection, cleaning, replacement of lamps, and external adjustments of equipment to obtain peak performance.

4-5. INSPECTIONS.

4-6. DAILY INSPECTION. The radio intercept facility should be inspected daily when in operation to insure that it is in good electrical and mechanical order. All controls should turn smoothly, but offer enough resistance to indicate a proper fit between respective shafts and bearings or packing glands. Packing gland nuts on control shafts which move loosely should be referred to maintenance support personnel for adjustment and proper lubrication in accordance with specific maintenance and overhaul directives.

4-7. PERIODIC INSPECTION. After long storage periods or extended periods of non-use, the entire facility should be checked for cleanliness, completeness, preservation, and operation. After periods of excessive vibration or shock, internal, and external fastenings should be checked for tightness.

WARNING

The radio intercept facilities utilizes voltages which are dangerous to life. Do not service or clean equipment when energized.

4-8. CLEANING.

The radio intercept facility should be inspected for cleanliness on a daily basis when in use and at least weekly when not in use. The exterior surfaces of each piece of equipment should be clean and free from dust, dirt, grease, and fungus. In addition to normal cleaning procedures to maintain the overall facility in a satisfactory condition, the following specific cleaning procedures should be followed:

WARNING

Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. Do not use near a flame.

a. Remove dust and loose dirt with a clean soft cloth.

b. Remove grease, fungus, and ground-in dirt from the equipment cases. Use a cloth dampened (not wet) with cleaning compound or pure alcohol.

c. Remove dust or dirt from plugs and jacks with a soft brush.

CAUTION

Do not press on meter face (glass) when cleaning; the meter may be damaged.

d. Clean the equipment front panels using a soft clean cloth. If difficulty in removing dirt occurs, dampen cloth with water. Mild soap may be used to make cleaning more effective. All surfaces should be wiped dry after cleaning. Care should be taken to avoid the leakage of water or soap into equipments.

e. Remove dust, film, and grease from equipment dial glasses and crt reticules using a clean, soft, lint-free cloth. The cloth may be moistened with pure alcohol to remove grease and film. Unnecessary cleaning of crt reticules and dial glasses should be avoided.

f. Use mild soap and water to clean parts made of rubber.

4-9. OPERATOR'S PREVENTIVE MAINTENANCE.

Preventive maintenance is the systematic care, servicing, and inspection of equipment by the operator to prevent the occurrence of trouble, to detect beginning failures, and to reduce downtime. For the radio intercept facility operator's preventative maintenance consists of the completing daily and periodic inspections as indicated in paragraphs 4-6 and 4-7; the cleaning as indicated in paragraph 4-8; and operator's performance checklists as contained in paragraphs 3-25 through 3-30. In addition, periodic checks of facility completeness as outlined in paragraph 2-2 and

inspection of line and signal cables for kinks, fraying, cracked insulation, and breaks should be conducted. Table C-19, appendix C, is a checklist for monthly maintenance and service inspections.

4-10. SPECIFIC PREVENTIVE MAINTENANCE PROCEDURES FOR COMPONENTS. In addition to the general preventive maintenance procedures in paragraph 4-9, the following specific preventive maintenance procedures apply to specific components of the radio intercept facility:

a. The RA6217E HF Receiver, RA6366 Panoramic Adapter, and AN/URR-52A VHF/UHF Receiver require no special operator maintenance other than inspecting, cleaning, and replacing fuses. This maintenance consists of keeping the face of the equipment clean and inspecting for loose knobs and dials. The operator should also check for blown fuses that appear ONLY on the equipment face and replace them ONLY with the specified fuse. The only maintenance performed by the operator behind the rack is to see that all connections are tight and are kept clean. All operator maintenance should be performed with NO POWER applied to the equipment.

b. The AG-500-2 Recorder requires proper preventive maintenance to ensure peak performance. It is essential that these maintenance tasks be performed as scheduled since the requirements of the AN/TSQ-54A necessitates a high load level of operating hours for this piece of equipment.

1. The following maintenance operations should be performed after each 8 hours of transport use:

(a) Clean the heads with a cotton swab and head cleaner. If no head cleaning solution is available, use isopropyl alcohol as a suitable substitute. The heads are easily accessible by raising the hinged head cover.

(b) Demagnetize the heads, capstan, and tape guides with any suitable head demagnetizer.

(c) Clean the capstan and pinch roller with isopropyl alcohol.

(d) Lubricate the tape guides with specified tape guide lubricant according to manufacturer operation and maintenance manual.

CAUTION

Care should be taken to ensure that tape guide lubricant does not come in contact with capstan or pinch roller. Should such an accident occur, remove the substance immediately and thoroughly with isopropyl alcohol.

(e) Inspect the reel hold down to ensure proper tension and adherence to reel hubs. If they appear worn or loose and have lost the properties necessary to hold the reels firmly, they should be reported for immediately replacement by maintenance support personnel.

2. Monthly inspections should be performed to include the following:

(a) Inspect the pinch roller to determine if it is worn or cracked. If inspection indicates the above conditions, refer to higher echelon maintenance personnel for replacement.

(b) Visually inspect all components at the back of the tape transports. Use a brush or a small vacuum cleaner to remove any accumulations of dirt or dust. If more comprehensive cleaning is required, isopropyl alcohol may be used. DO NOT use blowing action of the vacuum or any other compressed air device to clean the transports. Dust will be blown into the bearings and other rotating parts. If isopropyl alcohol is used, do not allow it to drip into critical areas.

c. The Antenna Control C-7120/G should be wiped down and kept dust free. All connections should be kept clean and tight and all fuses should be replaced when found defective.

d. The AB-746 mast should be inspected as often as possible due to the fact that it will jam if the slightest amount of dirt works its way between the tube and any of the latch components. All cables and turnbuckles should be inspected for fray and wear. Inspect all pulleys and pulley brackets to see that they are securely mounted and that cables are properly running over the pulley sheaves. Inspect the latch lanyard for fraying and kinks.

NOTE

A spring loaded safety latch, which is attached to the top of the second tube section, engages with a slot in the third section to prevent over-extending the mast lifting mechanism.

The tube and mast base should always be wiped down after each use. All exposed and accessible moving parts should be oiled during routine monthly maintenance, and especially after exposure to rain or protracted periods of dampness. The following parts of the masts should be lubricated:

CAUTION

Do not over-lubricate. Apply oil sparingly, and carefully wipe off all excess oil.

1. Lubricate the Griphoist levers and exposed moving parts.

2. Lubricate the mast base assemblies to include bolts and hinges.

3. Lubricate the threads of the turnbuckles and Snubit lock screws.

e. The AB-991-G Antenna Pedestal (rotator) should be inspected before elevation and after use. The rotator should be kept clean and well dusted. All external connections on the rotator should be kept clean because the slightest amount of dirt could cause a short in the electrical connections. The whole antenna system would become inoperative as a result. Inspect the adapter plate at the bottom of the antenna pedestal to ensure that mating surfaces are well lubricated with heavy grease.

f. For specific preventive maintenance instructions on the AN/TGC-14A(V) Teletypewriter Set, see paragraph 3-5, TM-03315-15.

g. No special operator maintenance is required for the AS-1898/B Antenna Assembly other than cleaning of the elements and inspection of the boom, fittings, and hardware. See paragraph 4-2 of TM-04659A-10 for specific instructions.

h. Instructions for preventive maintenance of the RA6397A Antenna Filter appear in chapter 3 of the manufacturer's manual RCI 84212.

4-11. MONTHLY MAINTENANCE.

Monthly maintenance on the radio intercept facility is scheduled in accordance with the requirements of the current edition of TM-4700-15/1_. If the equipment is vehicular mounted, the monthly maintenance should coincide with the vehicle maintenance schedule to minimize out-of-service time. All deficiencies or short-comings will be recorded. Those not corrected during the inspection and service will be immediately reported to higher echelon by use of forms and procedures specified in the current edition of TM-4700-15/1_. Equipment with a deficiency that cannot be corrected should be deadlined in accordance with the current edition of TM-4700-15/1_. Services listed in the monthly maintenance and inspection chart (table C-19), should be performed in the sequence listed.

SECTION III

SHIPMENT AND STORAGE REQUIREMENTS

4-12. GENERAL.

When shipping the radio intercept facility, the officer in charge of preparing shipment is responsible that the entire van is properly processed, that it contains appropriate shipping documents, and that it is shipped in a serviceable condition. When preparing the radio intercept facility van for either short- or long-term storage, special care should be exercised to ensure protection against deterioration caused by climate, lack of use, and storage time. Specific storage details are outlined in TM-740-90-1, Administrative Storage of Equipment.

4-13. SHORT-TERM STORAGE.

Preparations for short-term storage (90 days or less) must include inspections to determine where special emphasis and protective measures must be applied. Short-term protection includes proper cleaning, lubrication, and servicing of all units as though the radio intercept facility were to be placed in operation. Covering critical components with preservative sprays and weather-proofing will ensure continued preservation for approximately 3 months.

4-14. LONG-TERM STORAGE.

Steps to be taken for long-term storage (in excess of 90 days) of the radio intercept facility generally parallel those for short-term storage. The only difference is in the preservation details and the types of inspection required. As the radio intercept facility is being prepared for long-term storage, each preservation step is followed by an acceptance inspection. While the system is in storage, periodic inspections are required to ensure that protective measures have not lost their effectiveness. If any deterioration is noted, then a complete reapplication of protective measures is required. Records of all inspections and upgrading of protective measures must be maintained during periods of storage exceeding 6 months. (Use form NAVMC-10579-SD, stock number 0000-006-0930, for recording inspections.)

Existing local directives will govern preservation and storage procedures to ensure consideration of extremes of temperatures and adverse climatic conditions. If the requirements of this paragraph vary from those in TM-740-90-1, the procedures outlined in that technical manual take precedence.

4-15. LOWERING THE TELESCOPING ANTENNA MAST.

The 50-foot Antenna Mast, AB-746/U, requires particular care during the lowering process to avoid its total collapse. The following steps will ensure safety of personnel and equipment:

NOTE

Refer to paragraph 2-8 which discusses the raising of the telescoping antenna mast, in particular, paragraphs 2-8b27 through 35 and figures 2-12 and 2-13 regarding construction and use of the Griphoist.

a. From the operating shelter, change the antenna polarization to vertical.

b. Disconnect the antenna lead-in cable and pedestal control cables (figure 1-1) from the cable terminal (figure 1-6).

c. Loosen the lock screws on the upper guy Snubits and disconnect these cables from their anchor rings.

d. Bring Griphoist handle, cable reels, and antenna crates from storage. Attach the Griphoist handle to the lifting level, and operate the Griphoist to raise the mast just enough so that the safety locking pin can be withdrawn from the base tube.

e. Move the Griphoist handle to the lowering lever and push down until the Griphoist clutch pusher lock (6, figure 2-12) can be released.

f. Disengage the safety latch located between sections two and three of the antenna mast by pulling sharply on the release lanyard. When the latch is released, the red flag will disappear. Maintain tension on the lanyard until the mast has been partially lowered to prevent the latch from engaging again.

g. Operate the Griphoist until the mast sections have fully telescoped to complete the lowering procedure.

4-16. ANTENNA MAST DISMANTLING AND STOWAGE.

To dismantle the antenna and mast, proceed as follows:

a. Move the Griphoist clutch lever down and withdraw the main lifting cable from the Griphoist.

b. Remove the lock pin from the Griphoist mounting plate.

c. Lift the Griphoist off of the mounting plate and remove it.

d. Relieve the tension on the middle guys by releasing their Snubit lock screws.

e. Remove the middle guy cables from their anchor rings.

f. Operate the turnbuckles on the lower guys (figure 1-24) to relieve the tension on these cables, release their Snubit lock screws, and remove these cables from their anchor rings and from the mast base tube.

NOTE

Have two people support the mast before releasing the lock screws of the sliding plates in the base legs.

g. Remove the pins at each end of all three tubular struts and remove the struts.

CAUTION

Lay the mast carefully on the ground to avoid damaging antenna elements and antenna pedestal.

h. Remove the upper guy hooks from the adapter plate.

i. Remove the intermediate guy hooks (if used) from the eyes at the top of the seventh tube section.

j. Remove the middle guy hooks from the thimbles in the secondary lifting cables.

k. Remove antenna rf cable from antenna (figure 1-26). Remove antenna from pedestal (figure 1-22) and recrate the antenna. (See figures 2-2 and 2-3.)

l. Remove antenna pedestal (figure 1-23) from the top of the stub adapter tube.

m. Separate the antenna pedestal from the adapter tube by splitting the two halves of the pedestal mounting bracket (A, figure 2-9).

n. Store the antenna pedestal inside the shelter as shown in figure 1-4.

o. Remove the upper guy adapter plate from the stub tube.

p. The antenna mast is now completely dismantled and ready for stowage.

4-17. ANTENNA MAST STOWAGE PROCEDURE.

See figure 2-1 before stowing the mast and accessories, then proceed as follows:

a. Coil all guy cables onto their respective cable reels.

b. Connect the tubular struts to the base cover plate.

c. Swing the hinged base legs to their transit position, and place all accessories in the compartment thus formed.

d. Attach the base cover plate to the base legs using the captive wing screws in the cover plate.

e. Repack the antenna mast components in the shipping containers which were stored after the mast was installed.

APPENDIX A

REFERENCE PUBLICATIONS

A-1. GENERAL.

A-2. This appendix lists those applicable references available to the operator and organizational maintenance personnel concerned with the Radio Intercept Facility, AN/TSQ-54A.

A-3. Always refer to the latest issue of SL 1-2 and SL 1-3 before requesting issue of required publications.

Table A-1. Reference Publications

ID Number	Prefix Control No.	Publication Number	Title
	182 047000 00	TM-4700-15/1A	Records MC tactical equipment
03315B	123 033151 00	SL-3-03315B	Teletypewriter Set, AN/TGC-14A(V)
	124 033151 00	SL-4-03315B	Teletypewriter Set, AN/TGC-14A(V)
	160 748241 00	MI-03315B-25/2	Replace light diffuser AN/TGC-14A
	164 560450 00	SI-5815-35/1	Required maintenance test fixtures AN/TGC-14A(V)
	166 632439 00	TI-03315A-15/1A	Special installation instructions teletype, AN/TGC-14
	166 632550 00	TI-03315A-25/2	Replace bell mounting post teletype, AN/TGC-14
	184 033149 00	TM-03315-15	Teletypewriter sets, AN/TGC-14(V) and AN/TGC-14A(V), operation and maintenance
	184 033154 00	TM-03315-35/1	Preventive maintenance chart, teletype set
03844B	124 038441 00	SL-4-03844B	Radio intercept facility, AN/TSQ-54A
05499A	123 054990 00	SL-3-05499A	Panoramic data receiving set, AN/URR-52A
	124 054990 00	SL-4-05499A	Panoramic data receiving set, AN/URR-52A
	500 002950 00		Installation and Operation of Panoramic Data Receiver Set, AN/URR-52A (by C.E.I., Rockville, Md.)
05859A	124 058590 00	SL-4-05859A	Keyer, KY-463A/FGC
05859A			Instruction manual for KY-463A/FGC (by NSA)
05914A	123 059140 00	SL-3-05914A	Mast, AB-746/U
	124 059140 00	SL-4-05914A	Mast, AB-746/U
05914A			Instruction and maintenance manual for mechanical telescopic mast, M342 (by Craig Systems Corp., Lawrence, Mass.)
06631A	124 066310 00	SL-4-06631A	Shelter electrical equipment, S-280

Table A-1. Reference Publications (con.)

ID Number	Prefix Control No.	Publication Number	Title
	500 005140 00		Shelter equipment, S-280 (Craig part number J29775G1) operation/maintenance
06736A	124 067360 00	SL-4-06736A	Indicator panoramic, IP-989/URR-62
06736A			Instruction manual, panoramic display, panel-mounted, RA6502A (by RACAL Communications, Rockville, Md.)
06736A			Instruction manual, panoramic adapter, RA6366 (by RACAL Communications, Rockville, Md.)
06737A	124 067370 00	SL-4-06737A	Receiver, radio, R-1555/URR-62
	500 004554 00		Receiver, hf, RA-6217E, wideband (by RACAL Communications, Rockville, Md.)
			Antenna filter, RA6397A (manual number RC84212 by RACAL, cc1968)
06889B	124 068890 00	SL-4-06889	Recorder-reproducer, sound, RD-329/U
	160 890148 00	MI-06889-15-1	Shock hazard recorder-reproducer, RD-329/U-A/U
	500 004790 00		Recorder-reproducer, AG500/AL500, Ampex, 4890169-02 (ID 06889A)
06968A	123 069680 00	SL-3-06968A	Antenna rotor system, model R-3500 (AB-991/B)
	124 069680 00	SL-4-06968A	Antenna rotor system, model R-3500 (AB-991/B)
	184 069680 00	TM-069680-15	Operation and organizational maintenance manual for pedestal, antenna, AB-991-G, and control, antenna, C-7120/G
07093A	124 070930 00	SL-4-07093A	Coupler, antenna, CU-1863/FRR
	184 070935 00	TM-07093A-15	Coupler, antenna, CU-1863/FRR
07306	123 073060 00	SL-3-07306A	Monitoring set, radio signal, AN/TSQ-103
	124 073060 00	SL-4-07306A	Monitoring set, radio signal, AN/TSQ-103
82190B	123 821901 00	SL-3-82190B	Antenna, log-periodic, AS-1898/G

Table A-1. Reference Publications (con.)

ID Number	Prefix Control No.	Publication Number	Title
	124 046590 00	SL-4-04659A	Antenna, log-periodic, AS-1898/G
	162 007300 00	MI-82190B-35/1	Install H block ins/spacer AS-1898/U
	184 049810-02	TM-04659A-10	Change 2 to antenna assembly AS-1898/G
	600 004011 00	T.O. 35E9-116-1 by USAF	Air conditioner, self-contained, A/E 32C-17-operation
	600 004011 70	T.O. 35E9-116-1	Supplement
	600 004024 00	T.O. 35E9-116-14	Air conditioner, self-contained, A/E 32C-17
		TM-4120-15/1A	Principal technical characteristics of U.S. Marine Corps military standard air conditioners with supplemental logistic data
		SB-740-1	Storage and supply activity operations
		TM-740-90-1	Administrative storage of equipment

APPENDIX B

NONSTANDARD ABBREVIATIONS

B-1. GENERAL.

B-2. Abbreviations and acronyms used throughout this manual are either given in MIL-STD-12 and ANSI Y 10.19, or defined when first used in the text of the manual.

B-3. Nonstandard uses and uncommon variations of symbols are listed in the table B-1.

Table B-1. Nonstandard Abbreviations

Abbreviation Acronymn	Definition
dbm	Decibels referenced to one milliwatt (audio measurement)
EIA	Electronic Industries Association
IAW	In accordance with
MTBF	Mean-time-between failure
p.e.p.	Peak envelope power
rms	Root mean square
vswr	Voltage standing wave ratio

APPENDIX C

TECHNICAL CHARACTERISTICS

MECHANICAL SPECIFICATIONS

CONTROLS AND INDICATORS

C-1. GENERAL.

C-2. Appendix C contains all tables relating to equipments, operation, and general maintenance of the Radio Intercept Facility, AN/TSQ-54A.

C-3. The equipment tables show the inherent characteristics and the mechanical specifications.

C-4. The operational tables show the name and function of each control on individual equipment composing the radio intercept facility.

C-5. The maintenance tables contain information directly relating to maintaining all the equipment in the radio intercept facility.

Table C-1. Technical Characteristics and Mechanical Specifications of Receiver, RA6217E (See figures 1-7 and 1-10.)

Characteristics	Requirements/Specifications
Frequency range	980 kHz to 30 MHz (continuous tuning)
Reception modes	am, fm, cw, mcw, ssb
Tuning	Zero to 30 MHz with zero to 999-kHz digital readout at a setting accuracy of 250 Hertz (Hz)
Antenna input	Nominal 75 ohms
Stability	5 to 50 Hz over an 8-hour period at ambient temperature. Variation less than 50 Hz per degree Centigrade
Calibration	Internal calibration oscillator provides markers at 100-Hz intervals
IF outputs	2-3 MHz for RA6366 Panoramic Display; 1 MHz for frequency standard or diversity operation; 1.6 MHz wideband, and 455 kHz normal
Noise figure	Less than 10 db throughout
BFO range	Range for the beat frequency oscillator ±8 kHz (variable) with fixed crystal points at ±1.5 kHz, coarse and fine control facilities
RF input attenuator	0 to 40 db in 10-db steps (maximum counterclockwise)
AF output	600Ω (1 or 10 milliwatt level)
AF response	3 db at 100 Hz (corresponding with if bandwidth in use)
AF distortion	Less than 2%
AF linearity	Output linear within 6% over a 40-db dynamic range for inputs from 0.25 microvolts to 30 millivolts
Spurious response to external signal	a. More than 60 db down for signals less than 10% off tune b. More than 80 db down for signals more than 10% off tune
Power supply	100 to 125 and 200 to 250 volts at 48 to 420 Hz and approximately 10 volt-amperes (va)
Physical dimensions and weight	17" x 3.5" x 17" with 19" front panel; nominal weight is 25 lbs.

Table C-1. Technical Charactersitics and Mechanical Specifications of Receiver, RA6217E (See figures 1-7 and 1-10.) (con.)

Characteristics	Requirements/Specifications
Rear panel connections	a. Power cord, integral with plug-in ac power supply b. Antenna input, UG-1094/U mates with UG-88B/U c. Line audio outputs; -16 vdc regulated, unregulated, switched; manual gain line d. Main chassis: J102(in) and J103(out) for 1-MHz standard or diversity operation; J104 (out) and J105 (in) for low frequency converter or RA6366 panadapter (2-3 MHz); J106 (in) and J107 (out) for diversity operation or, external synthesizer outputs, or for use with RA6366 panadapter (3.6 to 4.6 MHz); J113 (out) 75 MHz wideband output for use only with RA6217C and RA6217E panadapter e. IF package: J3002 (out) standard 455-kHz converter for use with ancillary equipment; J3003 (in/out) 1.145 MHz output for diversity and input for use with synthesizer; J3004 (out) 1.6 MHz to RA6366 panadapter; TB3001 AGC bus terminal for diversity operation, AM DET (out) and AM DET (Detector) LOAD -- linked externally, except for certain diversity operations

Table C-2. Technical Characteristics and Mechanical Specifications of Antenna Filter, RA6397A (See figures 1-8 and 1-9.)

Characteristics	Requirements/Specifications
Frequency	1-30 MHz, in 1-MHz intervals to 20 MHz, and 5-MHz intervals to 30 MHz
Input/output impedance	75 ohms nominal
Insertion loss (measured at center frequency)	3.0 db nominal
Passband ripple	±1.0 db nominal
Shape factor -3 db to -30 db	1:2 or better
Switching	a. By reed relay at input/output of each filter b. By application of a negative 12-16 volts dc supply voltage to one of three control lines (A, B, or C) and a ground connection to one of 10 control lines (H through T). I, O, and Q are not used.
Power required	12 volts dc, approximately 22 millamperes
Environmental conditions	a. Operating: 0° to 55° C b. Storage: 40° to 70° C
Dimensions	19" wide by 1.75" high by 16" deep
Weight	8 lbs. (approximate)

Table C-3. Technical Characteristics and Mechanical Specifications of Panormaic Display, RA6366 (See figure 1-11.)

Characteristics	Requirements/Specifications
Input frequencies	RF mode: 2 to 3 MHz IF mode: 1.6 MHz ±37.5 kHz
Swept frequency range	a. RF mode: Adjustable from 100 kHz to 1 MHz b. IF mode: Adjustable from 7.5 kHz to 75 MHz
Resolution	a. RF mode: Capable of separating two equal amplitude signals spaced 10 kHz apart b. IF mode: Capable of separating two equal amplitude signals spaced 1 kHz apart
Sweep rate	4 Hz per second
Sensitivity: RF sweep set for 100 kHz in RF1 and, for 1 MHz in RF2 mode	With the gain control set to maximum, a 1-microvolt input signal to the RA6217E receiver will provide: (a) At least 1/4 full scale deflection in the RF modes (b) At least 1/2 full scale deflection in the IF mode
Frequency markers	a. Movable marker indicates the frequency to which the RA6217E receiver is tuned. Operable only in RF modes b. Fixed markers at 100-kHz intervals derived from the receiver calibrator c. If center frequency marker derived from the receiver calibrator
Display	Rectangular cathode ray tube with 2-3/4-inch x 1-1/8-inch screen. Blue-white fluorescence with long persistence. The face of the crt is covered with green plexiglass with engraved marks in the center and at each end.
Spurious responses	With a 1-microvolt reference input to the RA6217E receiver, all spurious responses appearing on the crt will be at least 50 db below the displayed signal on the crt.
Power supplies	Derived from RA6217. Line power supply unit: -16 volts dc regulated, 21 to 40 volts dc unregulated
Dimensions	8.5" wide, 17" deep, 3.5" high, with a standard 19" front panel
Weight	12 lbs. (approximate)

Table C-3. Technical Characteristics and Mechanical Specifications of Panoramic Display, RA6366 (See figure 1-11.) (con.)

Characteristics	Requirements/Specifications
Rear panel connections	a. Power cord, integral to the RA6366 b. Coaxial connections: J201 (in) 2 to 3 MHz amplifier input; J202 (in) for 2nd vfo input; J102 for 1.6 MHz narrow signal coming from the hf receiver; J101 for 1.6 MHz wide signal coming from hf receiver (USE ONLY J101 or J102 -- NOT BOTH) c. Control power connections on terminal block: -16 volts regulated; and -16 volts unregulated NOTE Refer to installation instructions prior to making connections.

Table C-4. Technical Characteristics and Physical Specifications of Receiver, AN/URR-52A (See figure 1-12.)

Characteristics	Requirements/Specifications
Type of reception	am, fm, cw
Frequency range	30 to 1000 MHz in four bands Band A 30-60 MHz Band B 60-300 MHz Band C 235-500 MHz Band D 490-1000 MHz
Input Impedance	To operate from 50-ohm source
Noise figure	Band A 4 db max Band B 6.5 db max Band C 10 db max Band D 12 db max
Image rejection	Band A 60 db min Band B 50 db min Band C 65 db min Band D 75 db min
IF rejection	Band A 54 db min Band B 80 db min Band C 80 db min Band D 90 db min
Oscillator to antenna conduction	Band A 15 µv max Band B 15 to 25 µv max Band C 8 µv max Band D 75 µv max
IF bandwidth	20 kHz - 75 kHz - 300 kHz - 2 MHz each operating selectively with if bandwidth switch on front panel
Spectrum Display	
Number of inputs	One (type BNC)
Input impedance	50 ohms
Input center frequency	50 kHz
Range of center frequency control	±10 kHz
Sweep width	Continuously adjustable from 0 to 3 MHz
Sweep linearity	Linear overall to within 5% of the total sweep width

Table C-4. Technical Characteristics and Physical Specifications of Receiver, AN/URR-52A (See figure 1-12.) (con.)

Characteristics	Requirements/Specifications
Sweep rate:	
200-kHz sweep width	Minimum 6-db valley between signals 6.0 kHz apart
50-kHz sweep width	Minimum 6-db valley between signals 3.0 kHz apart
20-kHz sweep width	Minimum 6-db valley between signals 1.2 kHz apart
5-kHz sweep width	Minimum 6-db valley between signals 300 Hz apart
IF frequencies	280 and 40 kHz
Oscillator frequencies:	
1st local oscillator	780 kHz ±1/2 sweep width
2nd local oscillator	320 kHz
Image rejection	50 db, minimum
IF rejection	60 db, minimum
Sensitivity	5 μv input at 500 kHz produces at least a 1-inch deflection on the crt.
Gain control range	60 db, minimum
Crystal marker	Frequency 500 kHz Tolerance ±0.01%
Amplitude scale	a. A signal 20 db down from the value that produces 100% vertical deflection will produce 10% linear deflection. b. A signal 40 db down from the value that produces 100% vertical deflection will produce 10% logarithmic deflection.
Power input	115/230 volts, 50 to 400 Hz
Power consumption	45 watts
Dimensions	19" wide, 15.5" deep, 5.25" high
Weight	35 lbs. (approximate)

Table C-4. Technical Characteristics and Physical Specifications of Receiver, AN/URR-52A (See figure 1-12.) (con.)

Characteristics	Requirements/Specifications
Rear panel connections	a. Power cord, quick disconnect type (J3); 1/4- and 1/2-ampere fuses; 115- to 230-volt ac changeover switch; remote power-on indicating connector (J2) b. Coaxial N-type connector (J1) for rf input on bands A through D (30 to 1000 MHz) c. Local oscillator outputs A13J3, A13J4, A14J3 and A14J4 from four tuners (See paragraph d below.) d. TB1 (8-pin barrier type): 1 and 2, audio output at 600 ohms; 3, 4, 5, and 6 to S1A W band indicator switch corresponding to 30- to 60-MHz, 60- to 300-MHz, 235- to 500-MHz, and 490- to 1000-MHz bands; 7, the 0- to 10-volt negative-going agc voltage; 8, chassis ground e. J17 (21.4-MHz output) 20/75/300-kHz if bandwidth; J18 (21.4 MHz output) 2-MHz if bandwidth. Both BNC-type with minimum levels of 75 μv into 50-ohm loads for input signal levels above agc threshold f. Common video output for all modes in both if strips (J3)

Table C-5. Technical Characteristics and Mechanical Specifications of Recorder/Reproducer, AG-500-2 (See figures 1-13 and 1-14.)

Characteristics	Requirements/Specifications
Tape width	1/4-inch
Tape speeds (inches per second)	1/2 - 15 ips or 3-3/4 - 7-1/2 ips
Maximum reel size	7 inches (EIA standard. Refer to table B-1.)
Fast winding time (1,200-foot reel)	60-Hz equipment: 110 seconds 50-Hz equipment: 128 seconds
Speed accuracy	15 ips: ±0.25% 7-1/2 ips ±0.25% 3-3/4 ips ±0.4%
Flutter and wow (Using flutter test tape IAW ASA Standard Z57.1-1954)	15 ips: 01% rms (root mean square) 7-1/2 ips: 0.13% rms 3-3/4 ips: 0.175% rms
Input	100,000 ohms, unbalanced. Will accept input signal levels as low as -18 dbm (decibels referenced to one milliwatt).
Output	Will feed a 600-ohm line, balanced or unbalanced, at a nominal +4 dbm output level. Maximum reproduce output level before clipping is +24 dbm.
Overall frequency response (500-Hz reference)	15 ips: ±2 db, 30 to 18,000 Hz 7-1/2 ips: ±2 db, 60 to 10,000 Hz +2, -4 db, 30 to 15,000 Hz 3-3/4 ips: ±2db, 50 to 7,500 Hz
Power line frequency	Both domestic and international equipment is available for use with one of two power line frequencies, either 60 or 50 Hz.
Power line voltage	Domestic: 105-125 volts ac International: Switch on electronic assembly can be positioned to select either 105-125 volts ac or 210-250 volts ac.
Power consumption:	
At 117 volts (domestic)	Tape transport: approximately 1.5 amperes Each electronic assembly: approximately 0.1 ampere
At 117 volts (international)	Tape transport: approximately 1.5 amperes Each electronic assembly: approximately 0.12 ampere

Table C-5. Technical Characteristics and Mechanical Specifications of Recorder/Reproducer, AG-500-2 (See figures 1-13 and 1-14.) (con.)

Characteristics	Requirements/Specifications
Power consumption: (con.)	
At 230 volts (international)	Tape transport: approximately 0.75 ampere Each electronic assembly: approximately .06 ampere
Microphone Preamplifier	
Gain	At least 57.5 db
Frequency response	±1 db, 50 Hz to 15,000 Hz
Output clipping level	No less than 2.5 volts rms
Signal-to-noise ratio	Not less than 50 db at maximum gain
Dimensions:	
Tape Transport	8.75" high, 19" wide, 9.25" deep
Electronics	3.25" high, 19" wide, 9.25" deep
Weight:	
Tape Transport	30 pounds (approximate)
Electronics	10 pounds (approximate)
Rear panel connections	a. Power cord, plugged into J118P on tape transport control box. Convenience outlet for trouble lamp or test equipment b. Interconnecting cable between tape transport and J11 on electronics unit c. Signal input connected to XY-type female connectors d. Input accessory sockets used for dummy plugs (unbalanced lines), or input transformers (balanced lines) e. Output connector (XL-type male), for attaching cable, shield and jumper as required f. Test jacks for record, reproduce, and erase heads

Table C-6. Technical Specifications of Teletypewriter Set, AN/TGC-14A(V) (See figure 1-15.)

Characteristics	Requirements/Specifications
Motor voltages	110 vac - 400 Hz - single-phase 110 vac - 60 Hz - single-phase 110 vac - 50 Hz - single-phase 28 vdc
Power requirements	Approximately 80 watts ac Approximately 65 watts dc
Receiving signal inputs	High range - any current between 10 and 80 ma Low range - any current between 1 and 5 ma
Baudot codes	7.42 standard but will accept 7.0 or 7.50 unit code with no mechanical or electrical changes
Operating speeds	368 opm - 60 wpm - 45 Baud 460 opm - 75 wpm - 56 Baud 600 opm - 100 wpm - 75 Baud
Inking ribbon	Standard 1/2" Underwood, self reversing
Recording medium	Standard full size roll (5" dia. x 8.5" wide) pressure feed paper, 1" hollow core
Characters per line	72 to 76 (adjustable)
Weight	In submersion-proof case complete with components, less than 40 pounds
Dimensions	In submersion-proof case with cover on in transit condition: 19" wide, 15" deep, 8" high
Signal input-output	MS-type screw connector mounted on rear apron

Table C-7. Technical Characteristics and Mechanical Specifications of Antenna Coupler, CU-1863/FRR (See figure 1-21.)

Characteristics	Requirements/Specifications
Frequency range	2.0-32.0 MHz
Impedance	Input 70- output 50-ohm impedance, vswr less than or equal to 2:1
Connectors	Input and output connectors are standard, BNC coaxial type, connectors.
Outputs	Eight
Gain	Between 1.0 db and 3.0 db
Noise figure	6.0 db nominal 7.0 db maximum
Intermodulation distortion (A11 2nd and 3rd order products are nominally 70 db down)	60 db below two, 0.25-volt rms, signals (maximum) 70 db nominal
Phase balance	Within ±2° between all outputs of any multicoupler and between any two multicouplers
Output to input isolation	Output to input isolation is greater than or equal to 50 db.
Interchannel isolation	40 db minimum
Interchannel gain difference	Less than or equal to ±0.5 db between all outputs of any multicoupler
Filters:	
Input band pass filter	40 db between 14 kHz and 18 MHz 40 db between 35 MHz and 150 MHz
Power line filter	60-db rejection 14 kHz to 150 MHz
Desensitization	2.0 volts rms will reduce a lower level signal by no more than 3 db.
Overload	10 volts rms continuous will not cause damage to circuit components.
Power consumption	Approximately 15 watts (nominal)
Input power supply	48 to 62 Hz, 115 ±10% vac, single-phase

Table C-7. Technical Characteristics and Mechanical Specifications of Antenna Coupler, CU-1863/FRR (See figure 1-21.) (con.)

Characteristics	Requirements/Specifications
Dimensions:	
Height	1-23/32"
Width	19"
Depth	Overall 14-1/2"
Weight	15 lbs. (approximate)
Reliability	MTBF 20,000 hours

Table C-8. Technical Characteristics and Mechanical Specifications of Antenna Pedestal, AB-991-G (See figures 1-22 and 1-23.)

Characteristics	Requirements/Specifications
Torque	550 inch-pounds
Speed:	
Azimuth	1.5 rpm
Polarization	1.5 rpm
Rotator:	
Azimuth	360° ±2°
Polarization	180° ±2°
Power input	115 volts ac, 50/60 Hz
Weight	41 pounds
Size:	
Height	18"
Width	9"
Depth	3.875"
Maximum allowable antenna weight	75 lbs.

Table C-9. Technical Characteristics and Mechanical Specifications of Antenna Mast, AB-746/G (See figures 1-24 and 1-25.)

Characteristics	Requirements/Specifications
Dimensions:	
Maximum elevated height:	
With adapter tube	50'
Without adapter tube	44'
Nested height:	
With adapter tube	13' 1/2"
Without adapter tube	7' 7-1/2"
Mast base section diameter	7-1/2"
Mast top section diameter	2"
Base plate height, folded	37-1/2"
Base plate diameter, folded	15-1/2"
Weights:	
Mast assembly	132 lbs.
Base and accessories	86 lbs.
Adapter tube	11 lbs.
Drive rod	10 lbs.
Total combined weight	239 lbs.
Environmental limits:	
Mast windload limits:	
Without ice	100 mph (87 knots)
With 1-inch radial ice	60 mph (52 knots)
During erection	30 mph (26 knots)
Frost/ice limit	1" radial
Maximum lifting capability	150 lbs.
Guy wires:	
Diameter	1/8" aircraft type
Strands	7 x 19 galvanized rope
Stress rating	2,200 lbs. (minimum)

Table C-10. Technical Characteristics, Antenna Log Periodic, Rotary Beam, AS-1898/G (See figure 1-26.)

Characteristics	Requirements/Specifications
Frequency range:	
Elements retracted	50 to 1100 MHz
Elements extended	30 to 50 MHz and 100 to 1100 MHz
Input Power	400 v rms
Gain:	
30 to 50 MHz	4 db (minimum)
50 to 1100 MHz	6 db (minimum)
Input impedance	50 ohms (nominal)
VSWR:	
30 to 50 MHz	3:1 or less
50 to 1100 MHz	3:1 or less
Beam width:	
Overall	Greater than 50°, less than 120°
High frequency	Greater than 50°, less than 70°
Side lobes	15 db (minimum) down
Input connector	Type "N" female
Weight (less transit case)	35 pounds (approximate)
Maximum wind	80 mph
Longest element	16".
Boom length	135" with fiberglass rod extended (11.25')
Turning radius	21' 4"
Number of elements	24
Transportability	Can be shipped by any mode of transportation in special transit container provided with antenna.
Storage conditions	No special requirements (in its own case).
Installation area required	Clear, flat area devoid of large objects and power lines.

Table C-11. Controls of Operator's Panel (See figure 3-11.)

Control	Function
Teletype input	Used to connect receivers A, B, or C; and either tape recorder into the teletype machine. Indicates when teletype is in use. Indicates when teletype is ready for operation after button is pushed.
Clear buttons (4 each)	Used to clear panel of all applicable inputs.
Antenna select	Used for selecting antenna. Works in conjunction with the AN/URR-52A receivers. See special section for details.
Receiver monitor	Used for selecting either receiver A, B, C, or a combination of A and B when special type workings are being monitored
Recorder 1 in	Used to operate recorder and patch receivers to recorders - will indicate recorder in use by other operator positions.
Recorder 2 in	Same as recorder 1 in.
Recorder monitor	Used in order to monitor recording or playback of either recorder by using the switch labeled OFF-1-2.
Foot pedal switch	Must be actuated before recorder will function. Used for switching foot pedal control from one recorder to the other.
Mic control	Used to patch operator's microphone either into the recorders or the intercom.
Intercom	When depressed, the intercom ring light will light on the supervisor's panel. This does not give an audible signal. Conversely it will light when an operator is called by the supervisor. NOTE Operators must go through the supervisor in order to talk to each other.
Power on	Used to activate the panel.
Microphone	Rest position for operator's microphone when it is not in use. Operator headset and microphone plug into control console at left on the lower oblique panel.

Table C-12. Controls of Supervisor's Panel (See figure 3-12.)

Control	Function
Recorder monitor	Used to monitor any one of the four recorders by moving the two upper left-hand switches to the appropriate position. A companion light will come on showing which recorder is being monitored.
Teletype monitor	Same as recorder monitor, but for two teletype machines.
Headset	Jack for plug of supervisor's monitoring headset.
Field phone:	
Direct	Direct terminals are used for normal field phone connections.
KY-8	If added security is desired and appropriate equipment is on hand, the two KY-8 terminals are used for field phone connections.
Ring-Off-Talk	Switch used to ring operators on the intercom. Appropriate lamp will light. To talk, supervisor places switch into the TALK position (down).
Position - 1 monitor	Supervisor places switch from OFF position into appropriate position (A, B, or C) to monitor hf receiver number 1 (1A), hf receiver number 2 (1B), or the vhf/uhf receiver (1C).
Positions - 2, 3, and 4 monitor	Same as position-1 monitor, except for positions 2, 3, and 4.
Power	Turns on and off the dc power for the supervisor's control panel.
Gain	Screwdriver (maintenance use) adjustment for presetting the intercom audio level.
Microphone	Rest position for supervisor's microphone (plugged into front of panel) when microphone is not in use.

Table C-13. Controls of HF Receiver, RA6217E (See figure 3-13.)

Control	Function
Function switch (second switch from top left)	This switch provides facilities for power OFF, MAN, CAL, and check B.F.O. along with three A.G.C. selections. The choice of time constants (SH. MED. LG) depends largely on mode conditions. The long time constant should normally be used with keyed cw or ssb signals and in conjunction with the manual rf(if) gain control as required. Short, medium, and long time constants may be used for fm, am, mcw or fsk, depending on fading conditions. For these modes of operation the manual rf(if) gain control should normally be kept at maximum.
Cal	In the calibrate position, 100-kHz markers provide an audio beat at each 100-kHz interval of the kHz digital readout. The readout scale may be corrected at the nearest 100-kHz point by using the CAL-FINE TUNE control (internal vfo only). NOTE When calibrating the KC readout, the DET-BFO MODE switch should be in the A.M. position.
BFO check	In this position the bfo freuqency may be set to coincide with the if center frequency by setting the B.F.O. mode switch to zero and adjusting the B.F.O. TUNE KC control. NOTE To avoid ambiguity the KC tuning control should be offset from any 100-kHz interval of the kHz digital readout so that no 100-kHz calibration beat note is audible.
RF attenuator	This control enables the operator to reduce the level of all incoming signals when strong unwanted signals are present which cannot be sufficiently rejected by tuning the antenna. The MIN position represents minimum attenuation (maximum rf gain).
RF mc - tune (top left switch -- smaller knob)	If maximum sensitivity is not required, the antenna need not be tuned unless strong unwanted signals are present. The presence of very strong signals anywhere within the spectrum may cause crossmodulation unless the antenna is tuned. NOTE Under these conditions, CARE MUST BE TAKEN TO AVOID TUNING THE INPUT TO THE INTERFERING SIGNALS instead of the desired signal.

Table C-13. Controls of HF Receiver, RA6217E (See figure 3-13.) (con.)

Control	Function
RF mc - range (larger knob, top left switch)	This switch provides for the selection of any one of five frequency ranges or a wideband position. Two wideband positions (one at either left or right travel limit of the switch) are provided for ease of operation.
2nd vfo ex-int (top left center of face plate)	Selects either the internal 2nd V.F.O. or an external 3.6 - 4.6 MHz source from a master receiver, frequency synthesizer, etc.
RF - af level (slide switch in center of face plate)	This control switches the meter to monitor either rf or af signal levels.
Cal - fine tune	This control enables the kHz (kilocycle--KC) digital readout to be calibrated at discrete kHz points or to correct small tuning errors when the kHz control is locked (internal vfo only).
MC control	This control (located to left of digital readout) selects the desired frequency in MHz (0-29) as shown on the first two digits of the readout. Its setting should be checked periodically to ensure that it is reasonably central with respect to the band in use. This is indicated by a reduction in signal or noise on either side of the correct setting.
KC control	This control (located to the right of the digital readout) selects the last three digits of the kHz readout (0-999). The KC dial knob can be locked by turning the outer locking ring. The first digital dial on the kHz readout will indicate either a decimal point, a plus sign, or a minus sign. When the decimal point appears the frequency can be read directly, but when the minus sign appears the true frequency can be determined by subtracting one from the units digit on MC readout (first number to the left of the minus sign). Conversely when the plus sign appears, the true frequency can be determined by adding one to the MC units digit.
Det - bfo mode	This switch (located second from top right on the face plate) selects either FM, two SSB positions, AM, or five coarse positions of the bfo.

Table C-13. Controls of HF Receiver, RA6217E (See figure 3-13.) (con.)

Control	Function
Det - bfo mode (con.)	In the FM position a frequency discriminator is used to demodulate the input signal. To demodulate usb (upper sideband) signals use the -1.5 position, and to demodulate lsb (lower sideband) signals use the +1.5 position. The AM position selects diode demodulation. Five variable bfo positions (+6 to -6) are used in conjunction with the bfo TUNE KC control providing a practical range of approximately ±8 kHz, (a theoretical range of ±9kHz) The bfo function is used to demodulate keyed cw, fsk, facsimile, etc.
BFO tune kc	This control (located top right corner of the face plate) operates as a vernier for the five coarse positions on the bfo mode switch. It has a range of approximately ±3 kHz.
IF bw kc	This control (located 2nd from lower right of the faceplate) selects any one of five bandwidth and its usual corresponding mode are listed below: 0.2 kHz - cw 1.0 kHz - cw or fsk 3.0 kHz - am or ssb 6.0 kHz - am 13.0 kHz - fm or am
AF level	This preset, screwdriver adjustable, maintenance control sets the audio level in separate stages for feeding a 600-ohm, 1-milliwatt line. It is unaffected by the position of the af gain control and its position should not be altered by intercept operators.
RF gain	This control (located in lower right corner of faceplace -- the smaller of two knobs) is operative both in the MAN and A.G.C. position of the function switch. When in the MAN. position, the control setting should always be at a minimum consistent with a satisfactory audio level. With the function switch in any of the three available A.G.C. positions, reducing the rf/if gain also reduces the agc gain which degrades the agc characteristics. Therefore in any of the agc positions it is desirable that the R.F. GAIN control be set for maximum rf/if gain. A possible exception to this occurs when receiving interrupted signals in which the carrier is periodically switched off. In this case, receiver noise could be troublesome during the no-carrier intervals and the rf/if gain must be reduced to avoid bursts of noise.

Table C-13. Controls of HF Receiver, RA6217E (See figure 3-13.) (con.)

Control	Function
AF gain	This control (located in lower right corner of faceplate -- the larger of two concentric knobs) adjusts the gain to the headphones and the 10 milliwatt output on the rear panel.
Dimmer	This control (located in left portion of the faceplate) adjusts intensity of the digital readout lamps.

Table C-14. Controls of Panadapter, RA6366 (See figure 3-14.)

Control	Function
RF sweep	This control adjusts the sweep width of the rf spectrum which can be varied from 1 MHz (fully clockwise) down to 100 kHz.
RF center	With this control, the positions of the displayed rf spectrum can be shifted horizontally on the crt only when the selector switch is in RF-1 or 2.
Intensity/off	This dual-function control switches on power to the unit and is also used to vary the trace intensity. Intensity of the trace increases with clockwise rotation of the control.
Focus	The definition of the displayed trace is adjusted using this control.
RF-1	This rf narrow band position provides for the resolution of two rf signals separated by 1 kHz or more. When operating in this mode, the rf sweep width should be reduced to 100 kHz (fully counterclockwise).
RF-2	This rf wideband position is used to observe rf spectrum from 1 MHz to 100 kHz by varying the rf sweep width for the desired spectrum width. This position provides for the resolution of two rf signals separated by 10 kHz or more.
IF	This position enables observation of various if spectrum widths, depending on the if bandwidth setting of the receiver. This position provides for the resolution of 2 signals separated by 1 kHz or more. In this position the receiver tuning marker is disconnected.
IF center	This control adjusts the horizontal position of signals when the rf/if switch is in IF.
IF sweep	This control is used to adjust the if sweep width which varies from approximately 75 kHz (fully clockwise) down to 7.5 kHz, only when rf/if switch is in IF position.
Horizontal	This control is used to shift the displayed trace left or right on the crt.
Vertical	With this control the displayed trace can be shifted up or down on the crt.
IF gain	This control adjusts the gain of the displayed signal; maximum gain is fully clockwise.
Marker on/off	This switch enables use of the receiver tuning marker in RF-1 and RF-2 only.

Table C-15. Controls of Recorder/Reproducer, AG-500-2
(See figures 3-15, 3-16, and 3-17.)

Control	Function
Tape Transport (See figure 3-15)	
STOP pushbutton	Used to stop tape motion and drop out record or fast-winding modes when applicable.
REW (rewind) pushbutton	Used to place tape in motion in fast-winding mode from takeup reel to supply reel.
FWD (fast forward) pushbutton	Used to place tape in motion in fast-winding mode from supply reel to takeup reel.
PLAY pushbutton	Used to place tape in motion in the reproduce mode. Must be pressed before record mode can be actuated.
Power toggle switch	Used to control application (on) or removal (off) of power for the tape transport and electronic assembly.
REC (record) pushbutton	Used to place equipment in the record mode. Tape motion must first be started by pressing the play pushbutton, and the record selector control on the electronic assembly must be in the ready position.
SPEED lever	Used to select high or low tape speed. Pushed in for low speed, pulled out for high speed. (Make speed selection only when the capstan is rotating.)
Electronic Assembly (See figure 3-16)	
OUTPUT SELECTOR rotary switch	Used to select either the input signal (signal to be recorded) or the reproduction signal (signal reproduced from the tape). The signal selected is connected to the monitor and output lines, and to the vu meter.
REPRODUCE LEVEL control	Used to adjust reproduce (playback) level.
RECORD SELECTOR rotary switch	Used to select either the safe condition (channel cannot be placed in the record mode) or record condition (channel can be placed in the record mode).
EQUALIZATION rotary switch	Used to select appropriate record and reproduce equalization for the low or high tape speed.
RECORD LEVEL controls (A and B)	Are used to adjust record levels for the A and B line inputs.
RECORD INDICATOR	Is illuminated whenever the equipment is operating in the record mode.

Table C-15. Controls of Recorder/Reproducer, AG-500-2 (See figures 3-15, 3-16, and 3-17.) (con.)

Control	Function
Meter	VU meter indicates record or reproduce level as selected at the output selector switch.

Table C-16. Controls of Antenna Control C-7120/G (See figure 3-18.)

Control	Function
Power switch	Turns the system on or off.
Polarization switch	Applies power to the polarization motor.
Azimuth switch	Applies power to the azimuth motor.
Polarization indicator	Indicates polarization position of antenna.
Azimuth indicator	Indicates direction antenna is pointing.

Table C-17. Controls of VHF/UHF Receiver, AN/URR-52A (See figure 3-19.)

Control	Function
Range switch	The range switch selects the proper tuner for use as determined by the frequency of the incoming signal. A lamp will light behind the tuning dial of the tuner selected.
Audio gain control and power switch	The combination audio gain control and AC power switch turns on the receiving system when rotated clockwise from the power off position. Once the unit is operating, this control sets the audio level at the phone jack.
Function switch	Set the function switch in one of the four positions before it's tuned. When this switch is in the AM/FM or CW positions, the gain of the receiver must be manually controlled using the RF GAIN. The bfo is automatically activated when the switch is placed in the CW mode.
BFO tuning control	The bfo tuning control allows the operator to change the pitch of the cw audio signal from the 20/75/300 kHz bandwidth strip when the function switch is placed in the BFO position. Place the BFO tuning control at mid position when tuning. The audio pitch can then be increased or decreased as desired.
IF bandwidth switch	The IF BANDWIDTH switch controls both if strips. Set this switch as desired depending on the characteristics of the signal to be received. This switch applies the video signal from either 2 MHz if or multiple bandwidth if strip to the video output jack J3.
RF gain control	The RF GAIN control is used to manually control the gain of the receiver sections (except the 2 MHz bandwidth if strip) when the function switch is in the AM/MAN or CW position. In the other two function switch positions the RF GAIN control is inoperative.
Tuning meter	The TUNING meter indicates the relative position between the incoming signal and the center of the if bandpass.
Cathode ray tube	The cry displays the signals present at the output of the tuner in operation.
Gain control	Use the GAIN control to adjust the amplitude of the display on the crt. Adjustment of this control does not affect the receiver sections of the unit.

Table C-18. Controls of Teletypewriter, AN/TGC-14A(V) (See figure 3-20.)

Control	Figure 3-20 Legend	Location	Function
MOTOR switch	1	Left side of printer, above keyboard	ON position turns on all primary power, except heater.
LAMP switch	3	Left side of printer, above keyboard	ON position lights the copy lamp. OFF position extinguishes the copy lamp.
SEND REC-REC switch	19	Left side of keyboard cover	REC position allows only reception, but not transmission; SEND REC position allows both keyboard transmission, printer reception, and keying of a remote radio transmitter.
BREAK push button switch	20	Left side of keyboard cover	Opens signal line; used to start motors when turned off by STOP key or time delay mechanism (AN/TGC-14A (V)).
FIGS key	18	Bottom row, extreme left-hand end of keyboard	Shifts teletypewriter set to figures condition, enabling punctuation and other symbols to be typed.
LTRS key	14	Bottom row, third from right-hand end of keyboard	Shifts teletypewriter set to letters condition, enabling all letters to be typed.
LINE FEED key	13	Bottom row, second from right-hand end of keyboard	Moves paper up one or two line spaces on paper feed rubber roll depending on position of LINE FEED shift arm.
CAR RET key	11	Middle row, extreme right-hand end of keyboard	Returns print cylinder to extreme left margin of paper.
BELL key FIGS "S"	17	Middle row, second from left-hand end of keyboard	Rings the signal bell, if struck after FIGS key, not after LTRS key.
STOP key (FIGS H)	15	Middle row, fifth from right-hand end of keyboard	In the AN/TGC-14(V), turns off motor to place machine in stand-by condition if struck after FIGS key, not after LTRS key.

Table C-18. Controls of Teletypewriter, AN/TGC-14A(V) (See figure 3-20.) (con.)

Control	Figure 3-20 Legend	Location	Function
		NOTE The symbol # is printed upon receipt of the figures H motor stop signal.	
REP key	10	Top row, extreme right-hand end of keyboard	Repeats the last character or function sent from the machine, for as long as the key is depressed.
Fastener studs	2	Both sides of front cover	Locks front cover in place and secures teletypewriter in case.
Alphanumeric keys		Keyboard	Causes the printing of the letter, or symbol, as shown on the key top.
Blank keys	12	Botton row, extreme right-hand end of keyboard	Transmits blank code group.
Space bar	16	Bottom of keyboard	Causes print cylinder to move to the right without printing.
Off-line carriage return button (<)	8	Top right side of front	Returns local teletypewriter set print cylinder to extreme left margin of paper.
Off-line letters button (⏚)	7	Top right side of front cover	Moves print cylinder of local teletypewriter set to letters position (will not operate unless an incoming signal or signals are being received).
Off-line figures button (⏚)	6	Top right side of front cover	Moves print cylinder of local teletypewriter set to figures position.
Off-line feed button (≡)	5	Top right side of front cover	Feeds copy paper on local machine.
Paper feed knob		Under front cover	Rolls the paper through the paper feed rubber roll to facilitate paper installation.

Table C-18. Controls of Teletypewriter, AN/TGC-14A(V) (See figure 3-20.) (con.)

Control	Figure 3-20 Legend	Location	Function
LINE FEED shift arm	9	Under LIFT panel	In the left position, causes the proper feed rubber roll to move one space; in the right position, causes the paper feed rubber roll to move two spaces.
PAPER lock pressure release lever	9	Under LIFT panel	Releases pressure on copy paper when moved to the right; grips paper firmly when moved to the left.
Keyboard lock bar	21	Left side of keyboard	Unlocks keyboard to allow movement to either operate or stowage position.
Copy window release	4	Levers are located at top right and top left of front cover	Unlocks copy window.
Time delay MOTOR STOP switch	None	Under front cover (AN/TGC-14A(V) only)	Enables or disables time delay motor stop feature.

Table C-19. Monthly Maintenance Service and Inspection Chart
(Refer to paragraph 4-9.)

Item No.	Procedure		References
	Item	Normal Condition or Result	
1	Initial check: Inspect the equipment for:		
	a. Completeness	a. Equipment must be complete.	a. Par. 2-2
	b. Cleanliness	b. Unit must be clean and dry, inside and out; free from grease, dirt, rust, corrosion, and fungus.	b. Par. 4-8
2	Publications: Check to see that pertinent publications are available.	a. Manuals must be complete and in usable condition without missing pages.	a. Appendix A
		b. All changes pertinent to the equipment are on hand.	b. SL-1-2 for requirements
3	Pluckout items: Inspect exterior hardware for looseness or binding.	All knobs must be present and firmly secured to their respective shafts.	
4	External hardware: Inspect exterior hardware for looseness or binding.	a. All knobs must be present and firmly secured to their respective shafts.	a. Par. 4-11
		b. Control and switch shafts may neither bind nor rotate ineffectively.	b. Higher echelon maintenance is required.
		c. All rack mounting and other hardware must be tight.	c. Par. 4-9
5	Cords and cables: Inspect ac line cords and signal cables for kinks, fraying, cracked insulation, and breaks.	Cords and cables must be in good condition. Tape frayed or cracked areas.	Par. 4-9
6	Interior: Inspect interior components and hardware for cleanliness and general physical condition.	a. Interior components and hardware must be free from dust, dirt, corrosion, fungus, and moisture.	a. Par. 4-8
7	Performance: Perform the procedures in the equipment performance checklist.	As stated in paragraphs 3-25 through 3-30.	Par. 3-25 through 3-30

Table C-19. Monthly Maintenance Service and Inspection Chart (Refer to paragraph 4-9.) (con.)

Item No.	Procedure		References
	Item	Normal Condition or Result	
8	Spare parts: Check all spare parts (operator and organizational) for general condition and method of storage.	All spare parts must be in good condition and properly stored. There should be no evidence of overstock, and all shortages will be on valid requisition.	None

APPENDIX D

DRAWINGS

D-1. GENERAL.

D-2. The drawings in this appendix were purposely made general so they merely serve as recognition guides rather than maintenance media.

D-3. More complete maintenance drawings and circuit schematics appear in technical manuals and manufacturers' literature cited in appendix A.

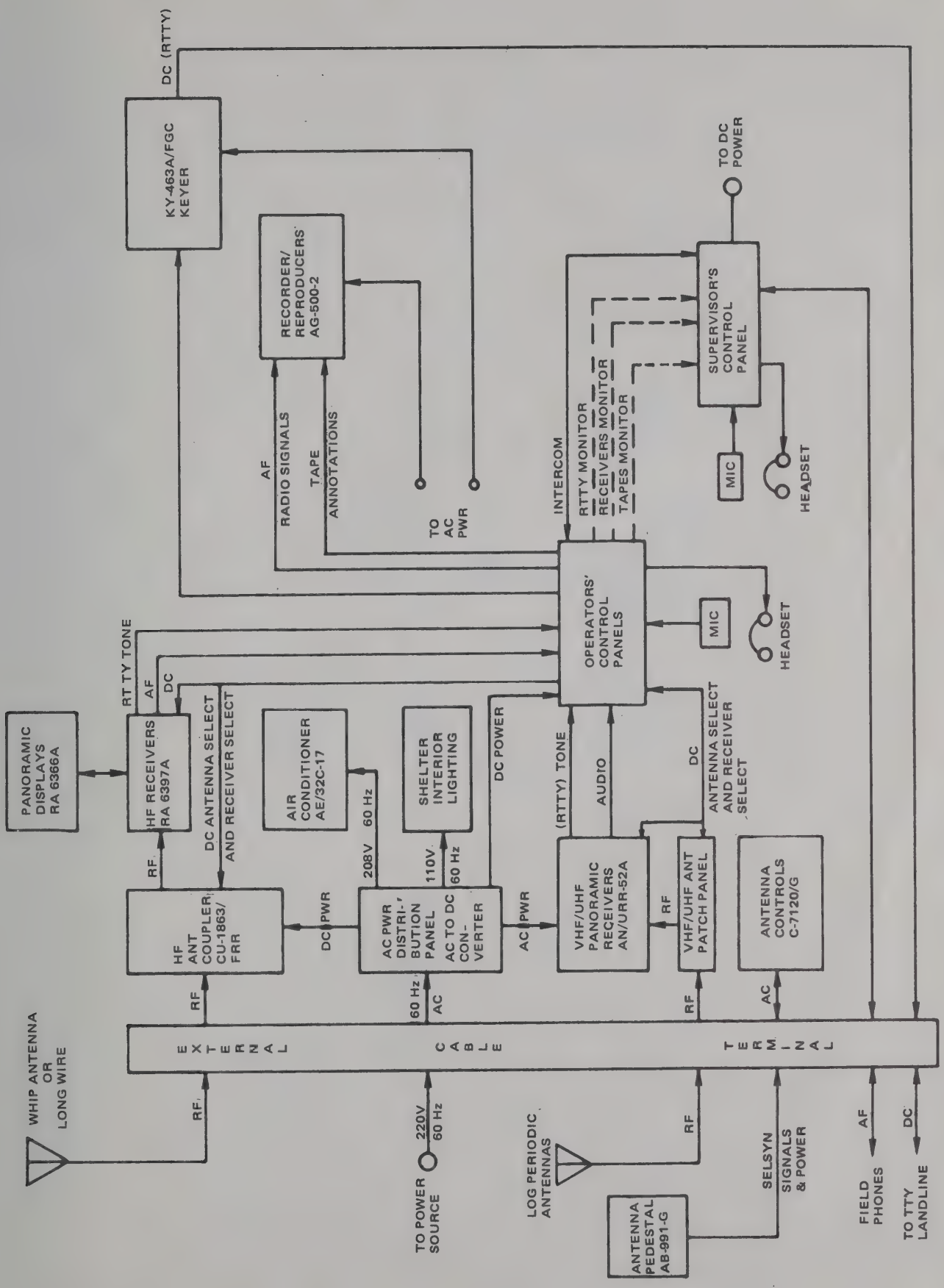


Figure D-1. Radio Intercept Facility, AN/TSQ-54A

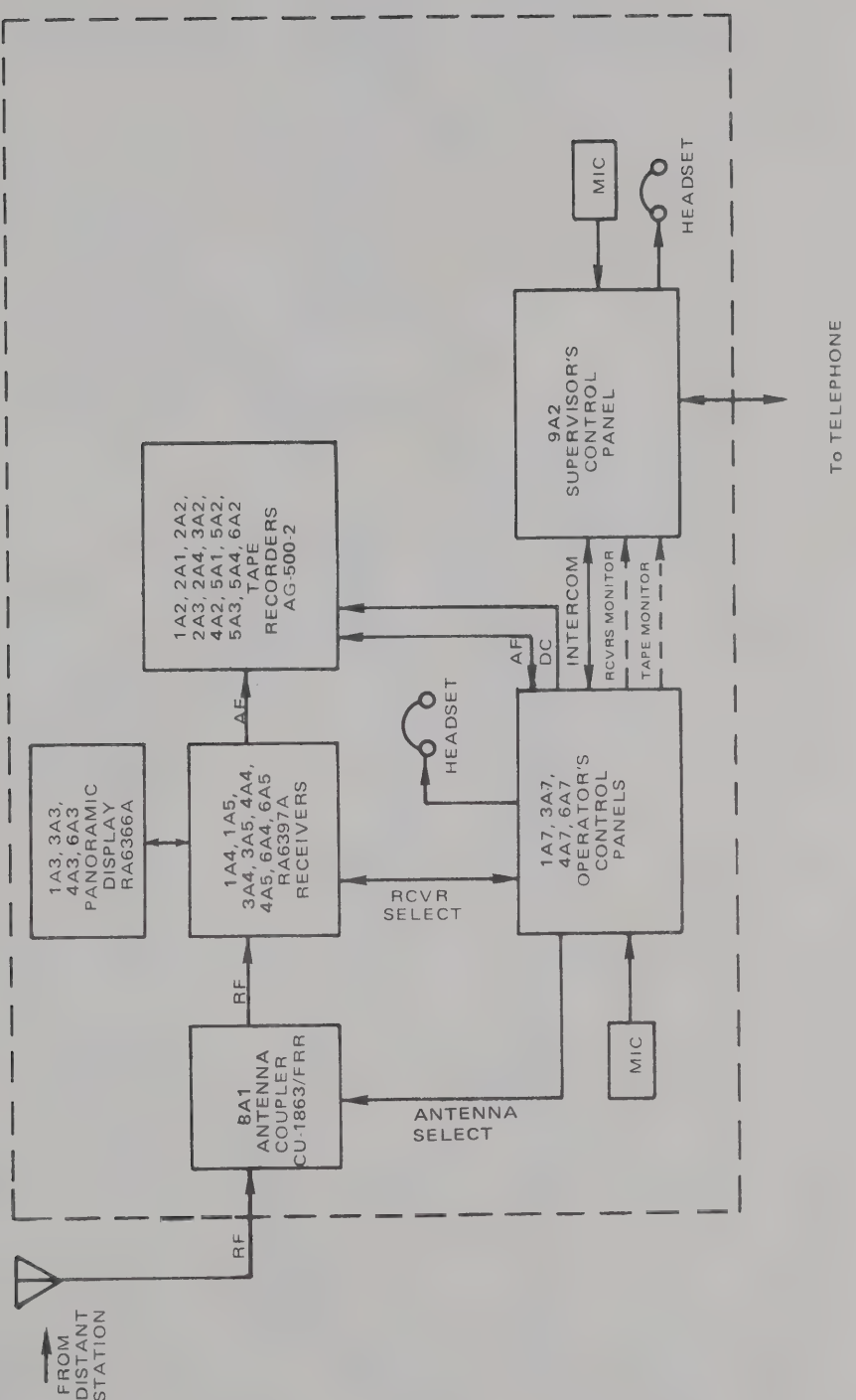


Figure D-2. Typical Manual Radio Telegraph (CW/MCW) Intercept Circuit, AN/TSQ-54A

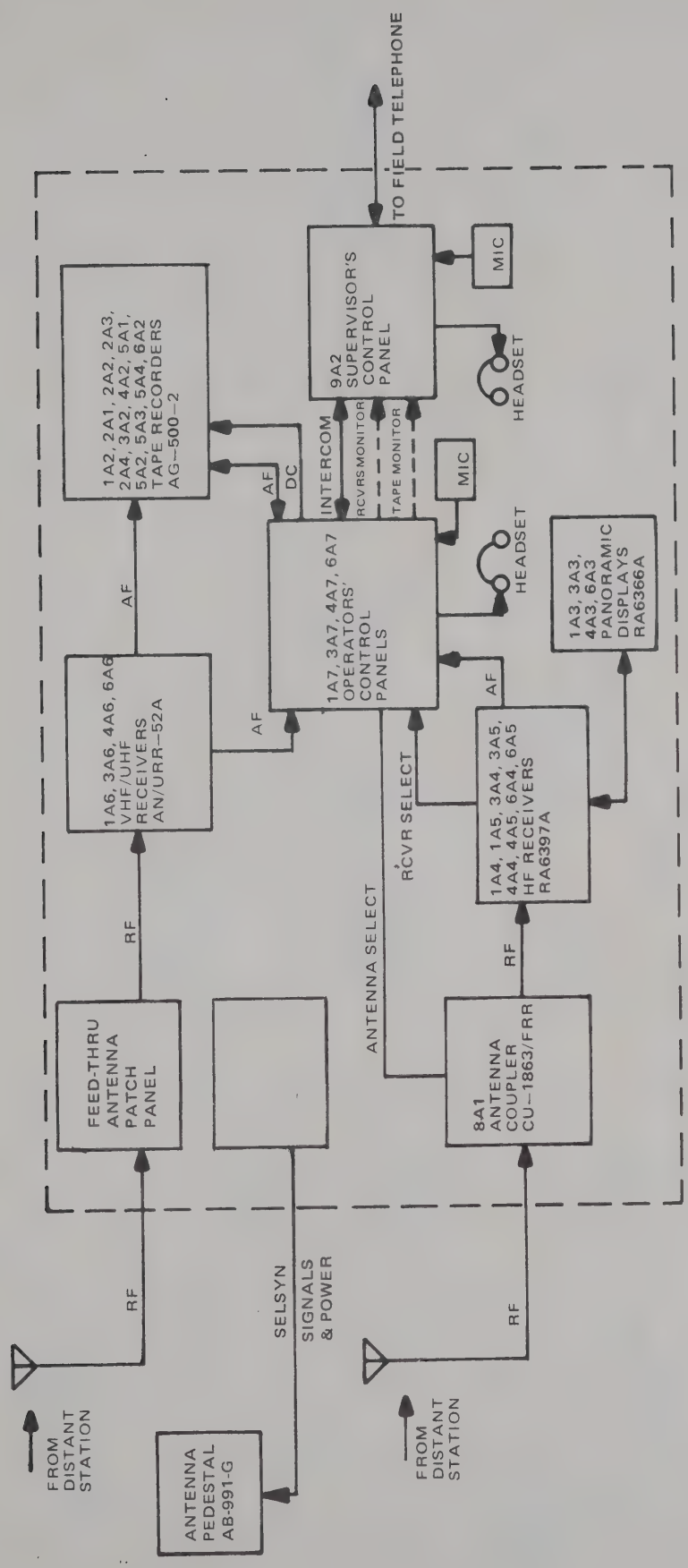


Figure D-3. Typical Voice (AM and SSB) Intercept Circuit, AN/TSQ-54A

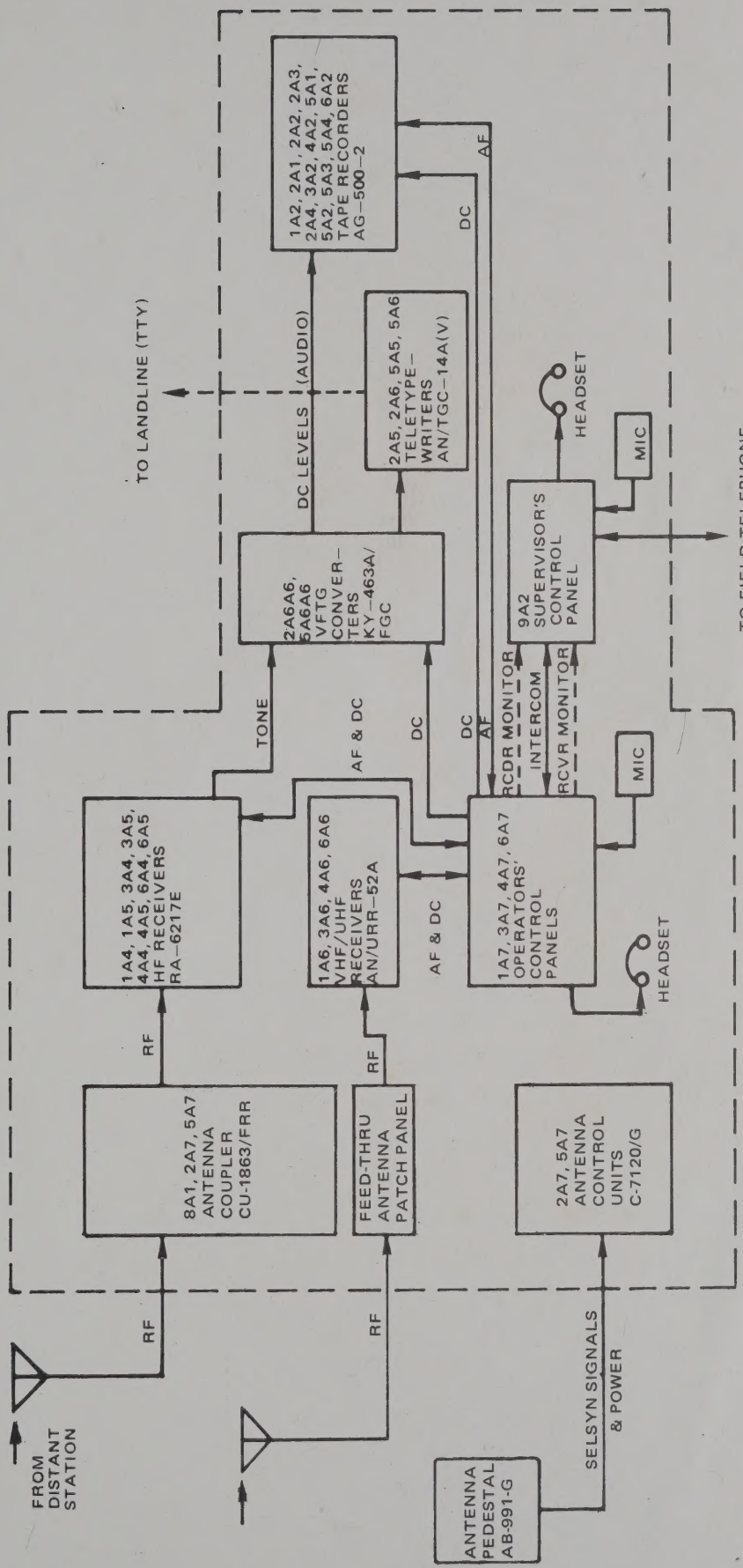
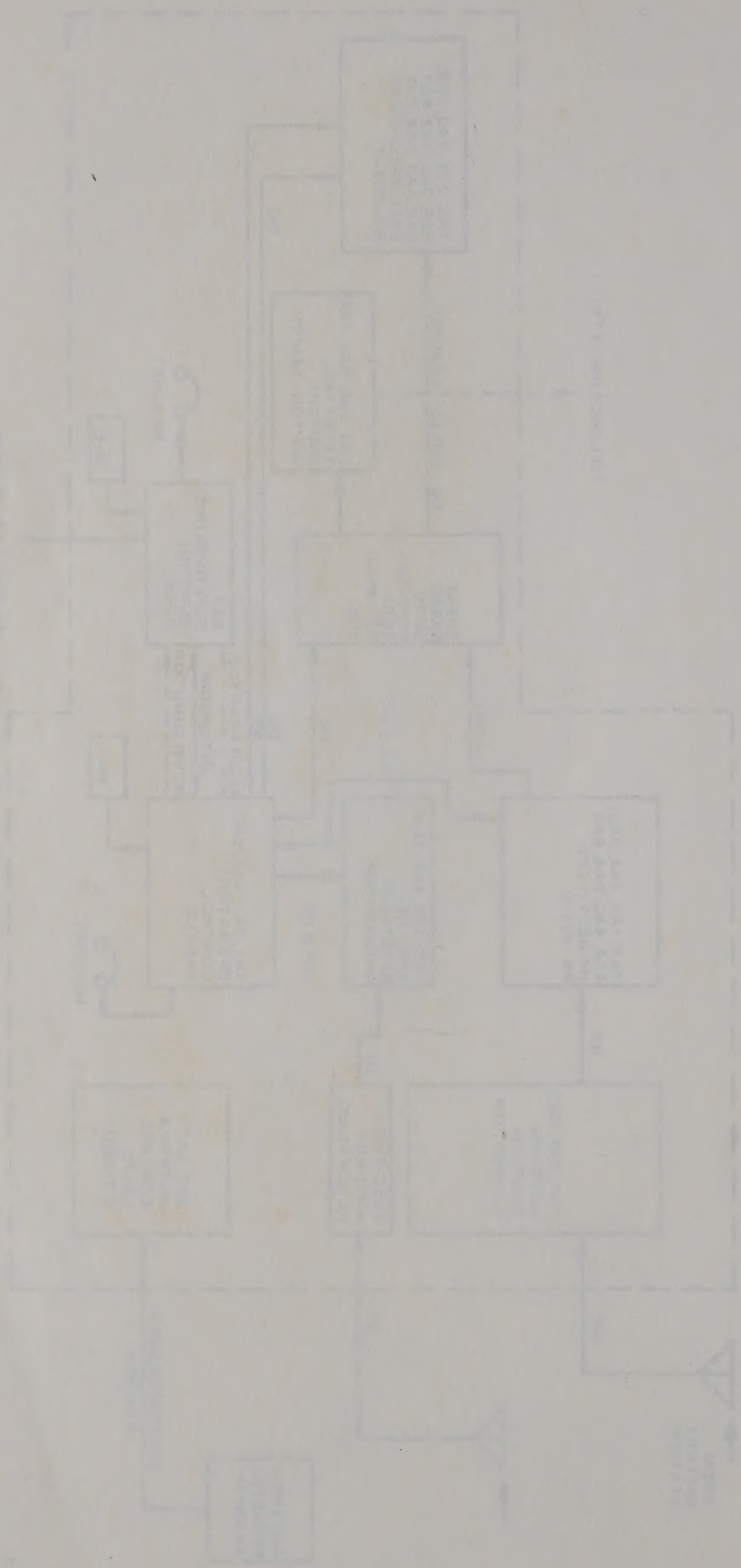


Figure D-4. Typical Radio Teleprinter Telegraph Intercept Circuit, AN/TSQ-54A

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